

LESSONS FROM SCENARIO PLANNING FOR WILDLIFE MANAGEMENT  
IN THE SOUTHWEST YUKON

by

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## **ABSTRACT**

The southwest Yukon social-ecological system (SES) is marked by complex changes, including a climate induced directionally changing landscape, an increasing shift away from traditional subsistence lifestyles, and changing species composition. The addition of “new” ungulate species through human and non-human introductions has spawned many management questions. This study developed qualitative scenarios through a participatory process, utilizing scientific and traditional knowledge from within the social-ecological system’s local context. The study worked with local management groups to address two main objectives:

1.) Collaboratively envision alternate future scenarios with management groups from which to collaboratively develop management goals for wood bison, elk, and mule deer to cope with the changing social and ecological landscape of the southwest Yukon and 2.) Discover resource managers’ and local stakeholders’ perceptions of scenario planning as a method identify wildlife management goals. A series of three workshops with the Alsek Renewable Resource Council, the Yukon Wood Bison Technical Team, and the Yukon Elk Management Planning Team addressed the first objective, while two surveys addressed the second objective. Major findings included southwest Yukon-specific wildlife management goals and considerations for using scenario planning in a wildlife management context. The scenarios themselves warn of plausible events that might unfold, such as novel disease and pest outbreaks. Several participants mentioned that the value attributed to different species will change based on scenario context. This prompts warnings for wildlife managers not to “shut the door” on a species today that may be

highly valuable for solving food security challenges of the future. Findings suggest that one of scenario planning's most significant contribution is a forum for people to share perspectives and develop trust and understanding of one another. All participants valued the holistic and long-term thinking aspects of scenario planning, seeing it as a complementary tool to enhance existing planning processes. Major resource management plans and/or resource development projects in the future should consider using a scenarios approach to better articulated goals in terms of whole system impacts.

**Key Words:** Adaptive capacity, Change, Elk, Mule deer, Participatory, Qualitative, Scenario planning, Social-ecological system (SES), Wildlife management, Wood bison, Yukon Territory

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To those who read this thesis:  
One thing that I've learned during this process is that  
you stand to learn a lot about a place from those who live there  
should you choose to listen.

## DEDICATION

I dedicate this thesis to Lizzie,  
who took a chance on love  
and look at what it has become.

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# **CHAPTER 1: INTRODUCTION TO THE STUDY**

## **INTRODUCTION**

### **Thesis Layout**

This thesis contains three chapters, an introductory chapter, a manuscript chapter, and a concluding chapter. The introductory chapter contains background information to provide context for the study. I use this background information to provide rationale for undertaking the study. A literature review of scenario planning communicates my familiarity with the method and with its different types and approaches used in similar research. Additionally I state the objectives of the study and provide the research questions used. Finally, I also use the introductory chapter to discuss my standpoint, and how this may or may not have influenced my interpretation of data.

The manuscript chapter is laid out in a journal article format. It contains an abstract, introduction, methods, results, discussion, and a brief conclusion. It is formatted for the target journal, Ecology and Society. The manuscript chapter targets the two main objectives of the study of using scenario planning to arrive at management goals under various scenarios, and then to evaluate scenario planning itself as a method for generating these goals. It provides lessons for wildlife managers both broadly and more specifically to the southwest Yukon. It also shares lessons for practitioners looking to use scenario planning.

The concluding chapter relates the findings from the manuscript chapter back to the larger social-ecological systems framework. In particular, I discuss

several personal speculations about how I think scenario planning can be used in the wider realm of resilience and systems thinking. I relate my observations of how scenario planning worked for participating wildlife managers in order to evaluate the applicability of using scenario planning as a tool for building resilience in the face of climate change.

It is important to note that the entirety of the scenario planning process was not completed. Participation in the final workshop proved difficult to organize and only a single day workshop was held. As a result, the important part of the scenario planning process, indicator development, is missing. The conclusion, therefore, provides a place to recommend indicators to guide southwest Yukon wildlife managers in their development. These indicators will help managers to identify system changes that may indicate directional changes towards one of the scenarios (Ralston and Wilson: 167). Effective indicators can prompt recognition of the need to enact management recommendations made in the workshops (Ralston and Wilson: 167).

## **Standpoint**

It is important for me to take space in this thesis to discuss my standpoint, or my perspectives and/or biases that I may or may not bring to the study. My role in this project is as an academic researcher trying to understand how wildlife managers might approach management differently while considering multiple futures. Though I see myself as a researcher, I do not think of myself as an objective observer. My experiences have shaped the way in which I see, interact with, and, most importantly for this study, the way I interpret the world around me.

I am a white male, born and raised in the United States of America. Being part of the white minority in my predominantly black high school helped me learn about different perspectives. This ability to see from other points of view aided my acceptance of participant contributions, since many participants held worldviews or came from backgrounds different from my own. This ability helped me again as a non-Canadian. Bringing an outside perspective helped me to listen to issues described by Yukon wildlife managers without prejudice.

Much of my formal education is rooted in positivist scientific approaches to problem solving. In university I majored in biology, concentrating on ecology and conservation. I also minored in environmental studies. I was inundated with examples of environmental degradation due to extractive industries.

Studying abroad in Kenya exposed me to different ways to approach research and conservation. Here I learned additional quantitative wildlife management techniques. More importantly, though, the program gave me my first exposure to qualitative techniques and the need to understand human factors and values in conservation. Having been exposed to those ideas prior to starting this study helped me to understand the importance when values were discussed as drivers of change. It also aided in my acceptance of the various qualitative methods used as a rigorous approach for this study. That acceptance is not a given for all individuals with a predominantly quantitative background.

These are just a few of the experiences that help shape me. But every experience, every encounter I have had has shaped my own unique lens. I see the world through this lens—whether I wish to look through it or not. Through this

filter, I had to internalize the workshop discussions and honestly represent them in the scenarios. Though the participants provided all of the raw data for the narratives, I wrote the narratives. For example, how participant contributions were strung together into a story was done by my hand and subject to my lens.

An important question to consider, therefore, is whether people's perspectives were represented accurately after passing through my own filters? Several different perspectives were represented in the workshops. For example, a few participants were First Nations, and therefore in some instances, had a different way of talking about the world. One instance in particular was when the scenario team discussed grouping drivers into the "Changing ecological-social interactions" axis. One First Nation participant adamantly argued for the inclusion of a few human-related drivers, indicating a holistic worldview, where humans are included in nature. Interestingly, this is a central tenet of SES thinking (Berkes and Folke, 1998) and was exactly the type of thinking we were asking for while using scenario planning within a SES framework. However, some non-First Nation's participants seemed to have trouble discussing the interactions of drivers from a non-dualistic perspective. Having both "human" and "natural" drivers present, despite being divided, seemed to represent holism for those participants.

Even though I subscribe to this non-duality, I am not Aboriginal. I wonder whether I captured how this idea is understood from the perspective of that particular individual of that particular First Nation. Step 15 of our scenario planning process asked the scenario team to review the scenario narratives and provide comment (Appendix A). This would have been an opportunity for the individual to

notify the author of the narratives (me) of any deviations from the individual's intent. However, in this particular case I believe I showed my inexperience as a facilitator and researcher. I should have been more forthright and asked the individual specifically whether the scenarios that I wrote reflected the intent behind the comments.

Another important issue to consider is whether my conservation background influenced what I included in the scenarios. There was a critique from a member of the Yukon Wood Bison Technical Team who did not participate in the workshops that the scenarios poorly represented benefits of high levels of industry, such as higher taxes that could be directed towards wildlife management. My answer to the critique was that first, I captured the tone of the workshops. Second, in scenarios where the prevailing ethic was exploitative, government might use taxes for increased infrastructure or non-stewardship purposes. Despite these lines of reasoning, did my lens influence the writing? Did I misread the workshop tone to be slighted more towards conservation than it was in reality? I continue this dialogue with myself in effort to check any biases that may enter the work.

There is no way to tell to what degree my own predispositions interfered during the study. It is important, therefore, for me to disclose that biases exist. There is no such thing as a perfectly objective study once imperfect people are used to collect and interpret data.

## **Research Purpose**

First and foremost, this research examines the management of the reintroduced Aishihik wood bison herd, introduced Braeburn and Takhini elk herds,



and naturally dispersing mule deer. These “new”<sup>1</sup> species have been ongoing forces of change within the southwest Yukon social-ecological system. Local stakeholders have many opinions and concerns on the matter. Specifically, the study builds from Dr. Douglas Clark’s socioeconomic impact assessment of the wood bison reintroduction on Champagne-Aishihik First Nation members (Clark, 2011).

However, this study is also about change and how society manages wildlife and people’s expectations during times of change. Some literature suggests that under today’s conditions of rapid change, conventional wildlife management planning is not meeting its intended goals (Berkes et al., 2003; Kay, 2008; Chapin et al., 2009; Kofinas, 2009). Conventional management was effective when ecosystems were in “constant” conditions or during times of predictable change (Armitage et al., 2007; Kofinas, 2009). But ecosystems can no longer be thought of as static, steady-state systems. Management that seeks to maintain the status quo and prevent change is not viable in these rapidly changing conditions (Armitage et al., 2007; Kay, 2008; Lister, 2008; Chapin et al., 2009). Therefore, conventional management approaches are inadequate. Adjusting governance to implement new solutions will be a critical factor for addressing the resilience of northern boreal forests (Chapin et al., 2010). Governance systems need to keep pace with social, economic, and technical changes (Kofinas, 2009).

Social-ecological changes continue to threaten native biodiversity, increasing the need to develop new adaptive management strategies (Rose and Burton, 2011).

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<sup>1</sup> “New” is italicized here for two reasons. It emphasizes that the appearances of the species are *relatively* recent. Additionally, it reflects the varying introductory statuses of the species. Both are discussed in subsequent sections of the paper. For simplicity “new” will not be italicized further.

Given concerns in the literature over the limitations of conventional management approaches, the purpose of this research is to examine a more holistic and potentially adaptive approach to wildlife management planning. The primary goal of this research was to test scenario planning as a tool to develop wildlife management goals. The study built on the literature of scenario planning used within an SES framework and within the field of wildlife management. The objectives of the study were:

- *Objective 1:* Create possible future scenarios and management goals for wood bison, elk, and mule deer in response to the changing social-ecological system of the southwest Yukon.
  - Specific questions to answer were:
    - What are drivers of change in the southwest Yukon?
    - What are plausible futures based on the drivers?
    - What are management goals that can help manage the landscape to a desired future scenario?
- *Objective 2:* Discover resource managers' and local stakeholders' perceptions of scenario planning as a method to identify management goals.

### **Southwest Yukon Management Context**

Recent years have seen an increase in cooperative management approaches in natural resource management and government policy (Folke et al., 2005). The southwest Yukon has a well-established history of resource co-management (Clark and Slocombe, 2009). With the settlement of land claims in the Yukon came the establishment of co-management boards and renewable resource councils with

equal government and First Nation representation (Umbrella Final Agreement, 1993). However, the co-management boards and renewable resource councils are advisory, making recommendations to the territorial government. Some have commented that this contributes to uneven power relationships between the territorial government and First Nation governments (Nadasdy, 2003). Even though there are avenues for the inclusion of First Nation perspectives and traditional knowledge, its context is most often distilled and forced into a western paradigm (Nadasdy, 2003).

In 1998, a wood bison management plan was drafted with a goal to cooperatively manage the Aishihik wood bison herd. This plan resulted in the formation of the Yukon Wood Bison Technical Team, which is comprised of Yukon government officials, members of affected First Nations, and other local stakeholders (Yukon Department of Renewable Resources, 1998). Similarly, in 2005, the Yukon Elk Management and Planning Team was established to provide advice about elk management. These planning teams act as bridging organizations, establishing a network of communication between institutions involved in the management of those species. SESs with networks that permit communication between management bodies have more opportunity for social learning (Berkes and Jolly, 2001; Folke et al., 2005). These systems also tend to have high adaptive capacity (Berkes and Jolly, 2001; Olsson et al., 2004; Folke et al., 2005; Folke et al., 2010). Local stakeholders in the Yukon have expressed interest in management with high adaptive capacity (Ogden and Innes, 2009). Therefore the management context

of the southwest Yukon provides an ideal landscape in which to test scenarios within a systems thinking framework.

### **“New” Species**

In the Yukon Territory, there is a history of recent changes in wildlife species composition. For example, cougar (*Puma concolor*) sightings have occurred in increasing number since 1944 and in 2000 the first indisputable, physical evidence of a cougar in the Yukon was found (Jung and Merchant, 2005). However, the most notable recent change to the mammalian community of the southwest Yukon is the appearance of wood bison (*Bison bison athabasca*), elk (*Cervus canadensis*), and mule deer (*Odocoileus hemionus*). Within the past 50 years, wood bison were reintroduced and elk were introduced into the territory. Additionally, mule deer and the occasional white-tailed deer (*Odocoileus virginianus*) are increasingly moving northward from British Columbia.

The new ungulate species in the Yukon, and different approaches wildlife managers can take to manage them are a central focus of this study. The new species show how the wildlife community is transforming, both by human and nonhuman intervention. Discussions regarding the species’ future management in the region are required. As part of an old rhetoric, the new species can provide additional hunting options for people in the southwest Yukon. This argument bears new weight as means to alleviate potential pressures of a changing landscape.

### **Wood Bison**

Around 90,000 years ago the steppe bison (*Bison priscus*), an ancestor of the

wood bison, first came to North America over the Bering land bridge (Guthrie, 1970). There is some debate regarding how and when wood bison disappeared from the southwest Yukon. It is thought that wood bison numbers decreased as a result of a slow conversion of steppe habitat to boreal forest (Government of Yukon, 2012), and that changes in climate increased the vulnerability of wood bison to hunting and predation by reducing herd size and isolating herds (Gardner and DeGange, 2003). Fossil records including bones and dung from SW Yukon ice patches indicate wood bison presence as recently as  $2840 \pm 60$  years ago (Farnell et al., 2004). Other bison parts, such as a 370 year-old molar, have also been found in the Yukon (Garnder and DeGange, 2003). Oral histories from Yukon First Nations tell of humans hunting wood bison into the early 1900s (Stephenson et al., 2001). Though uncertain, some argue that hunting may have possibly extirpating remnant populations and prevented repopulation of the area (Stephenson et al., 2001). Available oral and written history and paleontological data suggest that wood bison and people shared the Yukon for thousands of years up until the last century. These data identify the southwest Yukon as a portion of the wood bison's historic range.

In the 1970s the Canadian federal government initiated a national wood bison recovery program to restore wood bison to parts of their historic range, with the goal of establishing a viable free-ranging herd (Gates, 2001). The Canadian Wildlife Service identified the Nisling River Valley as a location capable of supporting a population of 400 animals (Gates, 2001). The number 400 was thought to be significant, as it was the estimate for a viable population at the time.

Between 1986 and 1992, 142 wood bison were reintroduced into the Nisling

River Valley. Done prior to land claims agreements (see UFA, 1993), the introduction included no First Nation consultation or risk assessment. The animals subsequently left the Nisling River Valley and travelled southeast onto Champagne Aishihik First Nation traditional territory, becoming known as the Aishihik herd. Yukon Territorial Government collects data on the herd via aerial surveys and radiotelemetry. Usually a member from the Champagne and Aishihik First Nations Heritage, Lands, and Resources Department is present. Population estimates are achieved using mark-resight techniques. Currently the population is an estimated 1230 (90% confidence intervals = 1106 - 1385) with a rapid calf recruitment rate of 17-21% per year (Government of Yukon, 2012).

The International Union for the Conservation of Nature and Natural Resources' (IUCN) Red List of Threatened Species lists the American Bison as *Near Threatened* (Gates et al., 2010), while within Canada wood bison are listed as a *Threatened* species in the federal *Species at Risk Act* (COSEWIC, 2004). Though once the population surpassed 500 animals, the Yukon territorial Wildlife Act listed wood bison as a *Big Game Species* and opened a hunting season (Government of Yukon, 2012).

Considering the species' status, the territorial government feels that there is a need to balance the conservation goals of a species-at-risk with the local community interests. Based on new modeling techniques population viability numbers for wood bison were changed to 1000 animals, which is reflected in the revised National Recovery Strategy for Wood Bison in Canada (National Wood Bison Recovery Team, In review). To maintain herd genetics, the revised National

Recovery Strategy asks for five of the nine wood bison herds in Canada to reach over 1000 animals (National Wood Bison Recovery Team, In review). Additionally, at the turn of the 21<sup>st</sup> century there were six free-ranging herds in Canada that were free of tuberculosis and brucellosis, the main diseases hampering wood bison conservation (Gates et al., 2000, Stephenson et al., 2001:126). With the Aishihik herd having surpassed the 1000 animal population target and being disease free, there is an impetus for this herd to be one of the five 1000+ populations in Canada.

However, there are concerns about the socio-economic and environmental impacts of the Aishihik Wood Bison Herd (Clark, 2011), some of which will likely be exacerbated with a herd of that size. The Champagne-Aishihik First Nation has an interest in maintaining the herd at 500 animals to minimize effects on the landscape, at least until those effects are better understood. The new management plan intends to allow managers to work within an adaptive management framework where many recommendations have been left for later development through working groups (Government of Yukon, 2012).

## **Elk**

Like bison, elk crossed the Beringian land bridge to come to North America, which for elk, likely occurred more than 10,000 years ago (Guthrie, 1966). An elk antler was found near Whitehorse dating to 1540 +/- 40 years ago, while other elk remains have been found at the Ibex ice patch dating to 2690 +/- 40 years ago (Farnell et al., 2004). It is likely that elk went locally extinct due to vegetation patterns changing to be more forested (Guthrie, 1966).

Evidence of historic presence fuel debate in the southwest Yukon as to whether the introduced population should be considered as an “introduction” or as a “reintroduction.” Such decisions can be controversial, such as the introduction of mountain goats (*Oreamnos americanus*) in Olympic National Park (Houston and Schreiner, 1995). Despite the debate, they are considered a transplanted species under the Yukon First Nations Umbrella Final Agreement. This means that elk are exempt from Yukon First Nations harvest rights (Yukon Elk Management Planning Team, 2008).

Interest in introducing elk began in the 1940’s when the Yukon Fish and Game Association lobbied for elk reintroduction in southern Yukon with the intention of reducing hunting pressure from other big game species (McCandless, 1985). A total of 168 elk were relocated from Elk Island National Park to the southern Yukon during the 1950’s (Yukon Elk Management Planning Team, 2008). As of 2008, the Takhini Valley Herd is estimated at about 200 animals and the Braeburn Herd is estimated at about 100 animals (Yukon Elk Management Planning Team, 2008).

Florkiewicz (1994) noted elk herds remained largely confined to areas of recent burn and grassy, south-facing slopes. Seemingly, environmental conditions that may have favored the animal in the past were not occurring in the boreal forest at that time (Florkiewicz, 1994). Recent studies show changes to the Yukon landscape, which may foreshadow the expansion of elk herds into new areas of expanding meadows and deciduous vegetation (Johnstone et al., 2010b). The most recent management plan for elk drafted in 2008 looked to address concerns of a



growing population in an era where wildlife management in the Yukon has evolved to be more cooperative as a result of the Yukon First Nation Final Agreements (Yukon Elk Management Planning Team, 2008).

### **Mule deer**

Hoefs (2001) states that between 1960 and 2000 there were 391 records filed by Yukon Fish and Wildlife Branch, reflecting 1101 mule deer sightings. The first mule deer was sighted in the 1940s and the species now has an established continuous distribution in suitable habitat in the Yukon. The first white-tailed deer was sighted in the Yukon at Tagish Lake in 1975 (Hoefs, 2001). They have remained rare in my study area and so will not be discussed further. Despite the demonstrated presence of deer in the territory, there has been little government management of the species due to the need to focus attention on more economically important species (Hoefs, 2001).

Deer prefer open areas such as grassy, south-facing slopes bordered by aspen, sites of recent forest fire, and/or cultivated fields (Hoefs, 2001). Climate changes in the southwest Yukon may result in a landscape with more open, grassy and shrub-like habitat (Johnstone et al., 2010a) and increased deciduous colonization after forest fire (Johnstone et al., 2010b). The potential for increased habitat suitability for mule deer meant the species should be given consideration in the study.

### **SW Yukon Physical Landscape**

Climate change is driving change in natural systems (Parmesan and Yohe,

2003) and in the Yukon Territory it has become a major area of public concern (Ogden, 2001). Rapid environmental change in northern North America has been documented in both oral history (see McDonald et al., 1997; Cruikshank, 2001; Krupnik and Jolly, 2002) and scientific studies (see Hinzman et al., 2005; Chapin et al., 2010). Climate scenarios predict that over the next 50 years the Yukon will become warmer and wetter with high variability and unpredictability (Ogden and Innes, 2009).

Local examples of environmental impacts associated with climate change include changes in spruce abundance and elevation during periods of warmer temperatures (Danby and Hik, 2007), droughts in southern Yukon which seem to be limiting white spruce (*Picea glauca*) growth (Griesbauer and Green, 2012), changes to the traditional fire regime which seem to be altering fire succession of spruce forests (Chapin et al., 2010, Johnstone et al., 2010b) and intense outbreaks of spruce bark beetles (*Dendroctonus rufipennis*) (Berg et al., 2006). A resonant example is the Takhini Valley burn of 1958. Burned areas have shown poor regeneration of white spruce. They have instead been colonized by trembling aspen (*Populus tremuloides*) interspersed with grassland (Hogg and Wein, 2005).

In the interior Alaskan boreal forests, forests that are similar to forests of the southwest Yukon, natural disturbances are more extensive than at any time in the historical record. These disturbances include permafrost thaw, wildfire, insect outbreaks, disease, and drying of lakes and streams (Chapin et al. 2010). Findings suggest potential shifts in the relative abundance of forest types that currently dominate the Alaskan boreal forest. Some examples include a decline in abundance

of spruce species (Chapin et al., 2010), a potential increase of deciduous forests (Chapin et al., 2010), and a conversion to grasslands or shrublands on dry sites (Johnstone et al. 2010a).

New forest species composition will have impacts on mammalian populations (Nelson et al., 2008). If, for example, deciduous vegetation dominates a post fire landscape lichens are less likely to recolonize (Cornelissen et al., 2001), causing a decline in caribou abundance or change in distribution (Chapin et al., 2010; Nuttal et al., 2005). In response to environmental changes, species will likely persist but will reorganize into new distributions and patterns of abundance (Chapin et al., 2010, Rose and Burton, 2011).

## **SW Yukon Social and Economic Landscape**

### **Economic Landscape**

Though land-based economies remain in the north, all northern communities that were once exclusively subsistence communities are now mixed economies that support subsistence activities with a cash economy (Usher et al., 2003). Though we must be careful about how we characterize northern communities (Haalboom and Natcher, 2012), there is concern that climate change will affect indigenous traditional ecological knowledge and predictive ability (Nuttal et al., 2005). This could reduce the self-confidence of local populations in making a living from their resources (Ford et al., 2010), which may further direct them towards jobs in the wage economy. Most regions of the north are dominated by a particular extractive industry, which provide opportunities for work (Chapin et al., 2004). It is important to note that the northern mixed economy functions along a continuum, with

individuals participating at differing levels in wage-based and/or land-based activities. For example, increased opportunities for wage labor in Inuit economies did not happen overnight, but rather over time since the 1950s (Ford et al., 2010).

Effects of the rise of the mixed economy can be seen locally in grocery stores. Over time major corporations have moved into Whitehorse, expanding ways to attain basic needs. On the other hand, competition from these larger stores has put some local stores out of business. For example, the closing of the local grocery store in Haines Junction, Madley's, means that many people now drive 1.5 hours into Whitehorse for food. Since not everyone is able to own or operate a vehicle, there now exists differential access for groceries for people living in the study area. While large stores and industry provide jobs, those same jobs can reduce the amount of time that people spend on land-based activities such as hunting and trapping. Among Inuit youth, for example, an increasing dependence on wage employment was reported to limit hunting activities to weekend or after work hours (Condon et al., 1995).

### **Cultural Landscape and Wildlife**

Northern indigenous peoples have deep cultural linkages to the landscape of the region (Trainor et al., 2007; Ford et al., 2010). Fish and wildlife resources remain important to the cultural identity to both indigenous and non-indigenous people of the Yukon (Usher et al., 2003; Chapin et al., 2004). Traditionally the lifestyle of southwest Yukon First Nations was based on family groups moving among areas with seasonally abundant food sources (Cruikshank, 2005).

Until recently, caribou (*Rangifer tarandus caribou*) were a main wildlife resource for First Nations of the southwest Yukon (Hare et al., 2004). Oral history states that caribou were more widespread as recently as the 1930s (Cruikshank et al., 1990). The abundance of dung found in melting ice patches indicates that caribou once existed in larger numbers in the southwest Yukon than what the present 1500 animal Aishihik herd would suggest (Farnell et al., 2004). For unknown reasons, in the 19<sup>th</sup> century caribou populations in the area declined (Cruikshank, 2005). People transitioned to moose (*Alces alces*) as a functional replacement (Cruikshank, 2005).

As habitat becomes less suited for some species it may become better suited for others. This may prove significant for people and cultures relying on subsistence species, or species hunted for survival rather than entertainment. Subsistence hunting communities that rely on multiple species will likely be more adaptive towards possible future landscape conditions (Nelson et al., 2008). Subsistence hunting communities are common in northern latitudes, regions that are experiencing changes to wildlife composition. Having the option of multiple species to hunt may be important as changes to the southwest Yukon social-ecological system occur.

However, people are responding differently to the experienced changes. A recent socioeconomic impact assessment identified nine negative impacts that the reintroduced wood bison are having on Champagne-Aishihik First Nations community members. Examples include worries of competition with other more culturally important wildlife and property damage (Clark, 2011). Partial rationale

for this study, therefore, was to build from that assessment, taking a holistic view of wildlife management to address people's socioeconomic concerns.

## **Literature Review**

### **Scenario Planning**

It is difficult to effectively plan within a social-ecological system. SESs have unknown feedbacks and unpredictable human actions (Carpenter, 2002). If they were more simple and predictable, we could plan using straightforward projections based on current trends (Wollenberg et al., 2000). But traditional environmental planning and management often fails to account for novel situations, which cause surprises in the system (Carpenter, 2002; Peterson et al., 2003). Surprises, such as pest outbreaks or changes in hunter patterns, illustrate how complex and uncertain reality is, and so creative processes for anticipating change such as scenarios are useful (Wollenberg et al., 2000; Alcamo et al., 2005).

By looking at a broad range of plausible futures, scenario planning shifts the analytical focus of estimating what is most likely to occur, which is common of predictions or forecasting, toward questions of what are the consequences and most appropriate responses under different circumstances (Duinker and Greig, 2007). "Scenarios" are simply "stories of possible futures" (Ralston and Wilson, 2006: 15). The scenario planning process considers multiple plausible futures with uncontrollable variables and high uncertainties. It links past and present events with hypothetical courses that examine the relationships of driving forces. It has a goal of creating more robust planning for events that may be unpredictable (Peterson et al., 2003; Ralston and Wilson, 2006: 125; Weeks et al., 2011). Scenarios

allow for a comparison of potential actions despite diverse models, multiple causes, and uncertainty of the future (Carpenter, 2002). They can spur action in the face of uncertainty by using realistic narratives to bring alternative possibilities to life (Carpenter, 2002).

The U.S. military began using scenario planning during the Cold War as military planning exercises. Herman Kahn and the RAND Corporation then incorporated the process into the business sector to plan for uncertain economic, social, and political climates (Chermack et al., 2001; Weeks et al., 2011). Shell Oil's success with the method encouraged numerous other corporations to consider its use (Chermack et al., 2001). Since then scenarios have ballooned into other sectors and has been defined by the Millennium Ecosystem Assessment as:

“Plausible and often simplified descriptions of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships” (MEA, 2005).

The adaptation of scenario planning to conservation and management is fairly recent (Peterson et al., 2003). Scenario planning has gained considerable traction as a tool to visualize future climate change and sustainable development implications. Climate scenarios, for example, represent possible future climates developed to determine the impacts of climate change (Beaumont et al., 2008). However, conventional science approaches of modeling and forecasting are often so inflexible as to be inappropriate, as are explanations of linear causality that underpin traditional ecosystem management (Kay, 2008). While models are improving, they are still highly uncertain and it is unlikely that improvements to models will

significantly reduce uncertainty within the next few decades (Schneider, 2003).

Such uncertainties can be addressed by incorporating management tools that consider alternative future scenarios (Meadows, 2002; Folke et al., 2005).

Many studies discuss possible species' distributions under different climate scenarios based on global climate models (see Fuller et al., 2008, Jensen et al., 2008, Maiorano et al., 2011, Rose and Burton, 2011). Other studies have been used to help engage local stakeholders to envision how climate change might impact their communities. For example, Sheppard et al. (2011) discuss a conceptual framework that can show the consequences of local actions or policies under different scenarios of future global and local climate conditions (Sheppard et al., 2011). Many of the global environmental assessment exercises have included a scenario component to help visualize future environmental challenges. Rothman (2008) offers a comprehensive list of environmental impact assessments that have used scenarios, but prominent examples include:

- The United Nations Environment Programme's Global Environment Outlook (UNEP, 2002, 2007);
- The Intergovernmental Panel on Climate Change's Emissions Scenarios (IPCC, 2000);
- The Millennium Ecosystem Assessment (MEA, 2005).

Various agencies involved with conservation have investigated the use scenario planning to accomplish their conservation goals. The U.S. National Park Service recognizes scenario planning as a way to devise and assess decisions under multiple potential climate futures (Weeks et al., 2011). Conceptualizing different



futures can help institutions to recognize changes, make decisions, change policies, and quickly adapt management to shift the system toward a more desirable future (Peterson et al., 2003, Weeks et al., 2011). Ideally a desirable future represents one that successfully achieves management objectives across a range of potential environmental futures (Ogden and Innes, 2009). Using scenario planning in a management context shifts the question from ““what do we think will happen” to “can we adapt to a radically different future?”” (Heemskerk, 2003: 9).

### **Building Scenarios**

When building scenarios it is important to tell multiple stories of the future that are broad in scope, utilize concerns of managers, and challenge the frameworks of decision-makers (Chermack, et al., 2001). Not including a broad scope or selectively choosing scenarios can result in a narrow consideration of possible futures and ultimately result in poor management decisions (Ralston and Wilson, 2006: 51; van Drunen et al., 2011). Some authors recommend creating at least four alternative scenarios in order to conduct an analysis that considers enough possibilities (Coffee and Meerwarth, 2004; Ralston and Wilson, 2006). Peterson et al. (2003) adds that scenarios that are imaginative are more likely to address unknown and unpredictable possibilities (Peterson et al., 2003).

Scenarios can take on many different forms, depending on the chosen type and approach (Wollenberg et al., 2000; Alcamo and Henrichs, 2008). Qualitative, participatory scenarios tend to be narratives or stories that and sometimes utilize pictures or other visuals to stimulate discussions of the future (Figure 1.1).

Quantitative, analytical scenarios tend to be numerical estimates of future conditions based on mathematical models, and will often be represented graphically (Figure 1.1). Scenario exercises that blend scenario approaches and types can take on a mixture of storylines and numerical estimates with a wide variety of visuals (See Figure 1.1)(Alcamo and Henrichs, 2008).

		<b>Scenario Type</b>	
		<i><b>Qualitative</b></i> (Focus on narrative)	<i><b>Quantitative</b></i> (Focus on numerical values)
<b>Scenario Development Method</b>	<i><b>Participatory Approaches</b></i>	Storylines, pictures (e.g. scenario panels, surveys)	Numerical estimates (e.g. expert evaluation)
	<i><b>Analytical Approaches</b></i>	Diagrams (e.g. rule-based / inference modelling)	Numerical estimates (e.g. integrated modelling)

**Figure 1.1.** Scenario types and approaches. Sourced from Alcamo and Henrichs, (2008).

### **Why a Qualitative, Participatory Approach?**

*Our Common Future* highlighted the importance of participation in the management of and planning for change (World Commission on Environment and Development, 1987). Subsequently, the United Nations has stressed the importance of education and building capacity to improve public and professional engagement in environmental decision making (United Nations, 2012). The southwest Yukon Territory is a region undergoing changes and involving local stakeholders in environmental decision making processes is instrumental for building adaptive capacity to those changes.

More specific to scenario planning, it can be helpful to involve local stakeholders in order to build robust, imaginative, and wide-ranging scenarios. Involving people to develop scenarios can bring forth more ideas of possible futures that come from outside of the decision-making or management framework (Schoemaker, 1995). This helps to address the core problem with decision-making of a narrow paradigmatic lens, aiding people to see decisions without the weight of habituated goals and pressures (Chermack, 2004). Palomo et al. (2011) argue that the involvement of stakeholders in the creation of scenarios improves decision-making (Palomo et al., 2011), because decisions identified and developed by local stakeholders are more likely to be consistent with local priorities, norms, and institutions (Chapin et al., 2006).

**Box 1.** Advantages of qualitative, participatory scenarios:

- Can examine nonlinearities and complicated causal links (Swart et al., 2004; Alcamo et al., 2005).
- Can capture non-quantifiable issues such as values and cultural shifts (Swart et al., 2004.)
- Can incorporate important ecological processes, which so far have not been satisfactorily considered in existing global models (Alcamo et al., 2005).
- Dialogue and debate during scenario development helps create a shared vision of the future and plans to achieve it (Peterson et al., 2003; Palomo et al., 2011).
- Scenarios that are developed based on the opinions and perspectives of the participants may support a feeling of ownership among stakeholders (Raadgever, 2008).
- Flexible participation provides a mechanism to facilitate feedback and social learning (Stringer et al., 2006).
- Only real limiting factors is the imagination of those creating them and the interest to participate (Wollenberg et al., 2000).

However, there are a few drawbacks to qualitative type scenarios. The most obvious is the failure to satisfy the perceived need for numerical information in

many environmental studies. Though it is wise to remember that “not everything that counts can be counted, and not everything that can be counted counts” (Cameron, 1963). Even so, many consider qualitative scenarios to be “unscientific,” because the procedure for developing them is usually not reproducible and due to the non-transparency of assumptions (Alcamo, 2008). In general, the assumptions behind qualitative scenarios remain in the heads of those that specify the scenarios (Alcamo, 2008). However, a scenario planning process can be completely transparent in instances where the scenario panel and decision makers are one and the same (Ralston and Wilson, 2006: 20).

### **Quantitative, Analytical Scenarios**

Not all scenario-based studies are participatory. Many scenario-based studies are purely analytical, involving no participation from stakeholders. Studies have used analytical, quantitative scenarios to understand, for example, environmental consequences of alternative land uses (see Eikhout et al., 2007) or potential species distribution changes under different climate scenarios (see Fuller et al., 2008; Jensen et al., 2008; Maiorano et al., 2011; Zelazowski et al., 2011).

Quantitative scenarios have their own drawbacks. Though they provide needed numerical information, the exactness of the numbers can portray a false sense of knowing more about how the future will unfold than we actually do (Alcamo, 2008). Another issue is that the complexity of models is often beyond the understanding of the average person, making the assumptions behind the scenarios difficult to comprehend (Alcamo, 2008). Lastly, and perhaps the most important

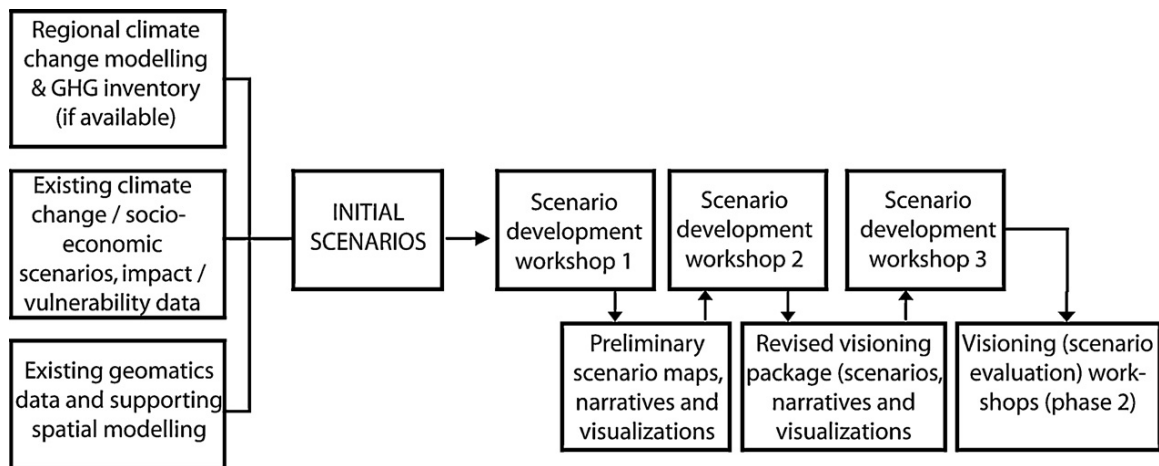
downside to quantitative scenarios, is that models can only capture a portion of the complex interactions of driving forces (Alcamo et al., 2005; Alcamo, 2008).

Quantitative scenarios based on mathematical models are good for simulating well-understood systems over sufficiently short times. But predictive ability decreases with increasing complexity of the system and lengthening time horizon (Swart et al., 2004). In other words, exclusively quantitative scenarios typically make poor simulations of complex social-ecological systems (Swart et al., 2004), such as the SES in this study.

### **Blended Scenario Approaches**

In order to compensate for deficiencies that qualitative and quantitative scenarios have on their own, some studies attempt to blend qualitative and quantitative scenario types (Alcamo et al., 2005). These studies often result in a blend of participatory and analytical approaches. Examples of studies have looked at possible implications of changes due to climate change (see MEA, 2005) and different climate change adaptation strategies (see Sheppard et al., 2011), or alternative land use policies (see Gibon et al., 2010). Studies that blend scenario development approaches and types often present an initial “business as usual” scenario that has been developed by an external team using existing data trends (see Figure 1.2). Sheppard et al. (2011) built scenarios using existing data and then showed the pre-built scenarios to community members. Community members then provided details to locally contextualize the scenarios and develop alternatives to the “business as usual” scenario. This blended methodology allows practitioners to

achieve the scientific rigor behind the global and regional models, while simultaneously localizing the scenarios and utilizing imaginative but contextualized ideas from stakeholders (Alcamo et al., 2005; Sheppard et al., 2011.) The result is easily understandable narratives that are consistent according to current scientific knowledge (Alcamo et al., 2005).



**Figure 1.2.** Example of blended scenario development process. Sourced from Sheppard et al. (2011).

## Scenario Planning within a Social-ecological system Framework

### Brief Background of Social-ecological system Theory

The term “social-ecological system” refers to the integrated concept of humans-in-nature (Berkes and Folke, 1998). It is the idea that a delineation between social and natural systems is a human construction whose perceptions can be changed. Social-ecological systems theory, then, places the human-in-nature principle into a systems perspective (Berkes and Folke, 1998).

In recent years, social-ecological systems thinkers have expanded and

clarified terms. Holling (1973) introduced the term “resilience,” as the ability of systems to absorb changes of state variables, driving variables, and parameters, and still persist (Holling, 1973). The definition has been clarified for use in social-ecological systems approaches to mean “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks” (Walker et. al., 2004).

Many authors have sought to define how resilience works in an applied sense (see Gunderson, 2000; Walker et al., 2002; Folke et al., 2010). For example, several studies have incorporated measures of resilience in SESs to understand a system’s capacity to resist change. Some have focused on changes as a result of climate change and other anthropogenic disturbances (see Chapin et al., 2004, Walker et al., 2009). Others have attempted to develop frameworks for analyzing resiliency in a SES (see Carpenter et al., 2001, Folke, 2006). Folke et al. (2005) argue that building resilience through management can increase an SES’s resistance to disturbances (Folke et al., 2005). On the other hand, Folke et al. (2004) argue that the tendency of a system to shift to a new stability domain is more likely after humans reduce resilience (Folke et al., 2004). These shifts can be caused by intentional human action (Walker et al., 2004). Some studies have even observed how transitions of this nature are possible (see Olsson et al., 2004, Fischer-Kowalski and Rotmans, 2009).

Several of these terms have relevance for this study and should be defined. Under certain environmental conditions, systems can have multiple stable states, or stability domains (Scheffer et al., 2001). A stability domain is defined as “a basin of

attraction in which the dimensions are defined by the set of controlling variables that have threshold levels” (Folke et al., 2010). If the variables that control a basin of attraction have low thresholds, a system might be susceptible to disturbances. Resilience therefore mediates the transition between stability domains (Gunderson, 2000).

Considering the widespread anthropogenic disturbance in the southwest Yukon SES, the above points about human action inducing system shifts is significant. The southwest Yukon SES seems to be in position to shift to a new stability domain. If a shift occurs, Gunderson (2000) lists 3 management options. Managers can either restore the system to a desirable domain, allow the system to return to a desirable domain by itself, or adapt to the changed system because changes are irreversible (Gunderson, 2000).

A fourth option is for management to be proactive. Resilience management looks to manage systems in such a way as to prevent an SES from moving into undesirable configurations in the first place (Walker et al., 2002). It depends on managers knowing where resilience exists in the system and how it can be lost or gained (Walker et al., 2002). To accomplish this, managers should look at the slow variables, such as land use, which can be more easily monitored and modified than stochastic events, such as disease outbreaks (Sheffer et al., 2001). At this point, southwest Yukon wildlife managers can either build resilience of the system to resist disturbances or attempt to direct the system to a desired stability domain in response to disturbances. A scenarios approach will help wildlife managers develop different strategies under different plausible scenarios.



## **Scenario Planning within an SES Framework**

Conventional science approaches can be interdisciplinary and participatory, but they often still focus on a single entity, such as a forest community. Complex system approaches are transdisciplinary, and can capture the holism inherent in a system (Kay, 2008). By examining interactions of driving forces, scenario planning attempts to look at a system holistically. Having an idea of the forces at work in the system, scenario team members can confront irreducible uncertainties. A scenario planning process can help decision makers visualize plausible future stability domains for a given SES and develop policies to direct the SES to a desired future scenario.

Gibon et al. (2010) stress the importance of representing local SES function in order for scenarios to adequately depict changes to specific system functions. By utilizing knowledge about the local SES function from stakeholders who live in the study area, scenarios can capture change in specific functions of the SES. Effective scenarios should be developed within a systems thinking framework (Chermack, et al., 2001) where interacting forces are examined and not just trends and uncertainties (Schoemaker, 1995). The focus on the relationships of driving forces is significant because small, persistent forces can alter species interactions, destabilize communities, and drive major biome shifts (Parmesan and Yohe, 2003). A scenario approach therefore, will help participants to identify important driving forces. Once the interactions between forces are highlighted, participants can develop an improved understanding of the SES and how management might build resilience of the system.

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## **TRANSITION**

This section is intended to transition the thesis from the introductory chapter to the manuscript chapter. It also outlines the contributions of the two researchers who worked on the study. Lastly, the section contains a table and figure. The figure is a timeline telling where various data sources come from. The table tells from which data sources the various themes come.

As mentioned in the layout section of the introduction, the manuscript chapter targets the two main objectives of the study. It discusses using scenario planning to arrive at management goals under various scenarios, and then evaluates scenario planning itself as a method for generating these goals. It provides lessons for wildlife managers both broadly and more specifically to the southwest Yukon. It also gives lessons for practitioners looking to use scenario planning.

### **Researcher Contribution**

There were two researchers involved with this study: Dr. Douglas Clark, the thesis supervisor and Dylan Beach (me), the Master of Environment and Sustainability student.

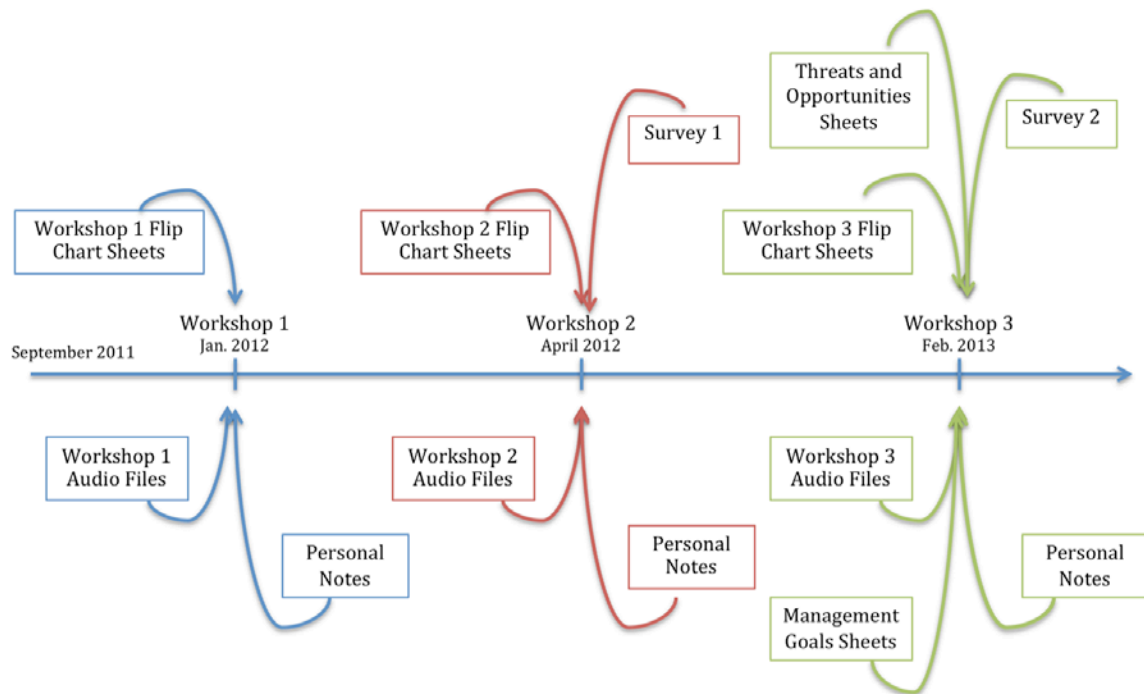
The following describes my own contribution. I designed the research process with the support of Dr. Clark. I adapted a corporate-focused scenario planning process described in Ralston and Wilson (2006) to a workshop process with Yukon wildlife managers. I developed the agenda's for each workshop, which Dr. Clark and I discussed and agreed upon prior to each workshop. I was the secondary facilitator during the workshops. I led facilitating when explaining steps

of the scenario planning process. I also successfully applied for a University of Saskatchewan research ethics addendum for additional ethics approval for a survey. I applied for the subsequent Scientist and Explorer's licenses to continue conducting research in the Yukon Territory.

Dr. Clark applied for and received two Social Sciences and Humanities Research Council of Canada Standard Research Grants to fund the research. He also prepared and submitted the applications for ethics approval from the University of Saskatchewan, and the initial Scientist and Explorer's license to conduct research in the Yukon Territory. Dr. Clark was the primary facilitator during each of the workshops. His duties included note taking, helping the group stay to the agenda, and facilitating dialogue. Dr. Clark also provided valuable guidance on a variety of topics related to the study.

### **Data Sources and Study Timeline**

This study occurred over 3 workshops. A timeline is presented for information that shows from which workshop each data source came (Figure T.1). In addition, 10 themes were synthesized from the workshops. A table is presented for information showing from which data sources the various themes came (Table T.1). The themes are addressed in the discussion section of the manuscript chapter.



**Figure T.1.** Data source and workshop timeline.

**Table T.1.** Themes by data source.

	Audio Files	Flip Chart Sheets	Management Goal Sheets	Personal Notes	Surveys	Threats and Opportunities Sheets
Application of Scenario Planning	X	X		X	X	
Broader Thinking	X	X		X	X	X
Clarification of Process	X				X	
Collaborative Discussion	X		X		X	X
Education	X	X	X	X		X
Experience	X		X		X	
Food Security	X	X	X	X		X
Importance of Context	X			X	X	
Perspectives and Values	X	X	X	X	X	X
Shortcomings of Conventional Wildlife Management Planning	X		X	X		X

## **CHAPTER 2: Lessons from scenario planning for wildlife management in the southwest Yukon**

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### **ABSTRACT**

The southwest Yukon social-ecological system (SES) is marked by complex changes, including a climate induced directionally changing landscape, an increasing shift away from traditional subsistence lifestyles, and changing species composition. The addition of new ungulate species through human and non-human introductions has spawned many management questions. This study developed qualitative scenarios through a participatory process, utilizing scientific and traditional knowledge from within the social-ecological system's local context. The study worked with local management groups to address two main objectives: 1.) Collaboratively envision alternate future scenarios with management groups from which to collaboratively develop management goals for wood bison, elk, and mule deer to cope with the changing social and ecological landscape of the southwest Yukon and 2.) Discover resource managers' and local stakeholders' perceptions of scenario planning as a method identify wildlife management goals. A series of three workshops with the Alsek Renewable Resource Council, the Yukon Wood Bison Technical Team, and the Yukon Elk Management Planning Team addressed the first objective, while two surveys addressed the second objective. Major findings included southwest Yukon-specific wildlife management goals and considerations for using scenario planning

in a wildlife management context. The scenarios themselves warn of plausible events that might unfold, such as novel disease and pest outbreaks. Several participants mentioned that the value attributed to different species will change based on scenario context. This prompts warnings for wildlife managers not to “shut the door” on a species today that may be highly valuable for solving food security challenges of the future. Findings suggest that one of scenario planning’s most significant contribution is a forum for people to share perspectives and to develop trust and understanding of one another. All participants valued the holistic and long-term thinking aspects of scenario planning, seeing it as a complementary tool to enhance existing planning processes. Major resource management plans and/or resource development projects in the future should consider using a scenarios approach to better articulate goals in terms of whole system impacts.

**Key Words:** Adaptive capacity, Change, Elk, Mule deer, Participatory, Qualitative, Scenario planning, Social-ecological system (SES), Wildlife management, Wood bison, Yukon Territory



## **INTRODUCTION**

### **Research Purpose**

Some literature suggests that under today's conditions of rapid change and complexity, conventional wildlife management planning is not meeting its intended goals (Berkes, 2004; Kay, 2008; Chapin et al., 2009; Kofinas, 2009; Gibeau, 2012). The resilience of northern boreal forests will, among other things, depend on human capacity to adjust governance to implement new solutions (Chapin et al., 2010).

Given concerns for the viability of conventional management approaches, the purpose of the research was to test a more holistic and potentially adaptive approach to wildlife management planning. To accomplish its goal, the study had two objectives. First, use a participatory, qualitative scenario planning approach to develop management goals for wood bison, elk, and mule deer in response to the changing social-ecological system of the southwest Yukon. The second objective was to discover resource managers' and local stakeholders' perceptions of scenario planning as a method to identify management goals. The research had both practical and theoretical contributions. It provided practitioners with a new management tool and way of thinking, thereby improving adaptive capacity. It also contributed to the literature of scenario planning used within a social-ecological systems framework.

### **Qualitative, Participatory Scenario Planning**

"Scenarios" are simply "stories of possible futures" (Ralston and Wilson, 2006: 15). The scenario planning process considers multiple plausible futures with uncontrollable variables and high uncertainties. It links past and present events

with hypothetical courses that examine the relationships of driving forces. It has a goal of creating more robust planning for events that may be unpredictable (Peterson et al., 2003; Ralston and Wilson, 2006: 125; Weeks et al., 2011). Scenarios can spur action in the face of uncertainty by using realistic narratives to bring alternative possibilities to life (Carpenter, 2002).

Scenarios can take on many different forms, depending on the chosen type and approach (Wollenberg et al., 2000; Alcamo and Henrichs, 2008). Qualitative scenarios tend to be narratives or stories that sometimes utilize pictures or other visuals to stimulate discussions of the future (Wollenberg et al., 2000; Alcamo and Henrichs, 2008). The involvement of stakeholders in the creation of scenarios improves decision-making (Palomo et al., 2011). This is because decisions identified and developed by local stakeholders are more likely to be consistent with local priorities, norms, and institutions (Chapin et al., 2006).

### **Scenario Planning within Social-Ecological Systems (SES) Theory**

Social-ecological systems contain many unknowns and layers of unpredictability, producing complex planning environments (Carpenter, 2002). If SESs were more simple and predictable, resource managers could plan using straightforward projections based on current trends (Wollenberg et al., 2000). But traditional environmental planning and management often fails to account for novel situations, which cause surprises in the system (Carpenter, 2002; Peterson et al., 2003).

Effective scenarios should therefore be developed within a systems thinking framework (Chermack, et al., 2001) where interacting forces are examined and not

just trends and uncertainties (Schoemaker, 1995). The focus on the relationships of driving forces is significant because small, persistent forces can alter species interactions, destabilize communities, and drive major biome shifts (Parmesan and Yohe, 2003). Complex system approaches are transdisciplinary, and can capture the holism inherent in a system (Kay, 2008).

### **Social-ecological system changes**

The southwest Yukon SES has, and is currently, experiencing social, economic, and ecological changes. Significant for this study is the appearance of “new”<sup>2</sup> species wood bison (*Bison bison athabasca*), elk (*Cervus canadensis*), and mule deer (*Odocoileus hemionus*). The ungulate species in the Yukon and different approaches wildlife managers can take to manage them are a central focus of this study.

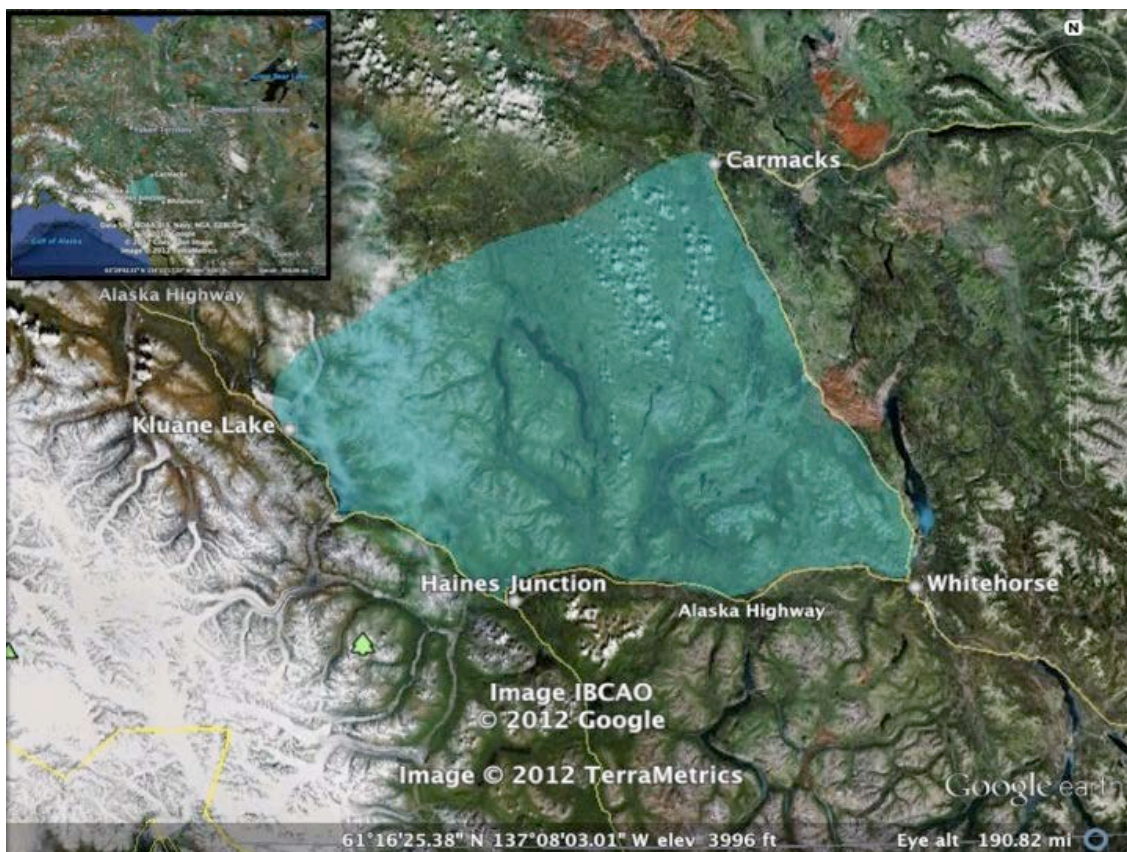
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<sup>2</sup> “New” is italicized here for two reasons. It emphasizes that the appearances of the species are *relatively* recent. Additionally, it reflects the varying introductory statuses of the species. Both are discussed in subsequent sections of the paper. For simplicity “new” will not be italicized further.

## METHODS

### Study Area

Study participants defined the “southwest” Yukon to be bound by Haines Junction, Whitehorse, Carmacks, and Kluane Lake (Figure 2.1). This area was determined to roughly coincide with the Aishihik Wood Bison Herd range as well as Champagne-Aishihik First Nations traditional territory. The research looked at the entire social and ecological system meaning there is an emphasis on the human cultural presence, economic conditions, and the physical features and processes of the ecosystem.



**Figure 2.1.** Study site. Southwest Yukon bound by Whitehorse, Haines Junction, Kluane Lake, and Carmacks (Google Earth, 2012).

The 4 scenarios looked 20 years into the future. Participants felt that 20 years was a good reference point because it is approximately a generational time frame and bison have been on the landscape for about that amount of time.

### **Study Participants**

The research was multi-scale. It involved the Yukon Wood Bison Technical Team and the Yukon Elk Management Planning Team, which have representation from local and regional-scale management groups. The bison and elk teams were established to discuss and make management recommendations to the Yukon Fish and Wildlife Management Board. They are comprised of representatives from Environment Yukon, Environment Canada, affected First Nations, and affected Renewable Resources Council. They also receive input and have representatives from interest groups such as the Yukon Agriculture Association, the Yukon Fish and Game Association and the Yukon Outfitters Association.

The bison and elk teams have both First Nations and non-First Nations membership. As such, both First Nation and non-First Nation members were encouraged to participate, and did (See Table 2.1). As Yukon First Nations settled Land Claims agreements with the Government of Canada and the Government of Yukon, they were assigned rights to co-manage traditional lands and resources within their traditional territories. As mandated by the agreements, Renewable Resource Councils were established to provide recommendations on the management of fish, wildlife, and forest resources to governments. These councils gave local First Nations and Non-First Nations community members a voice in renewable resource management (Ogden and Innes 2009).

Originally the study was intended to focus exclusively on wood bison. Therefore, members of the Yukon Wood Bison Technical Team were invited to workshop one. During workshop one it was agreed to expand the study to also discuss elk, and mule deer. Together these 3 species represent the new ungulates in the region. Members of the Yukon Elk Management Planning Team were invited to participate in the subsequent workshops.

Participants all lived in the southwest Yukon (See Table 2.1). There were both female and male participants (see Table 2.1) who were given equal opportunity to contribute. They also all had experience with wildlife management. Therefore they are considered diverse, local stakeholders as well as experts. Many, if not all of the participants, had a working knowledge of the social and ecological underpinnings of this SES.

**Table 2.1.** Participant demographics.

<b>Respondent ID</b>	<b>Gender</b>	<b>Community</b>	<b>First Nation</b>	<b>Workshops attended</b>
1	Female	Champagne	Yes	1, 2
2	Male	Mayo	No	1, 2
3	Male	Whitehorse	No	1, 2, 3
4	Male	Whitehorse	No	1, 2
5	Male	Haines Junction	No	1, 2
6	Female	Haines Junction	Yes	1, 2, 3
7	Male	Haines Junction	No	2
8	Female	Whitehorse	Yes	3
9	Male	Whitehorse	Yes	3
10	Male	Carmacks	No	1, 2, 3
11	Female	Mendenhall	No	1, 2
12	Female	Whitehorse	No	1, 3
13	Male	Champagne	Yes	1
14	Male	Haines Junction	No	1
15	Male	Haines Junction	No	1

## Scenario Planning Process

*The Scenario Planning Handbook* (Ralston and Wilson, 2006) was selected to guide us through the scenario development process for three main reasons. First, it offered a systematic and detailed approach to conducting scenario workshops and developing scenarios. This served to guide the conversation through a rigorous agenda during workshops that were limited in number.

Second, it described a participatory scenario development process. We hoped a participatory process would build capacity for participants and help them feel a sense of ownership for the scenarios ultimately presented.

Lastly, the approach in the handbook easily transitioned from a corporate context to a wildlife management context. Some authors argue that a scenario development and planning process used in one context can be adapted to fit other contexts (Wollenberg et al., 2000; Ralston and Wilson, 2006). Even though, in a wildlife management context the focus may be on forces shaping an ecosystem rather than future demand for a product, the conversation still revolves around the relationships between forces shaping the future.

Ralston and Wilson's (2006) scenario planning process describes 18 steps. The first six steps amount to organizing the process, including gaining support for the process, selecting a focus, and arranging a scenario team. The next set of steps involves analyzing the environment, including describing key forces and uncertainties and writing storylines. The final set of steps moves the process from scenarios to goals, including rehearsing different futures, making recommendations, and identifying signposts to monitor (Ralston and Wilson, 2006). This study

followed those steps with several adjustments to fit both a research and wildlife management context (Appendix A). See Appendix A for a description of the scenario planning process steps.

## **Workshops**

The workshop is a communicative and collaborative process. This research was collaborative and participatory. It built on existing research relationships maintained by Dr. Douglas Clark in the southwest Yukon. Repeated workshop events build relationships, allow trust to grow, demonstrate commitment, and improve the quality of discussion and therefore data (Huntington et al., 2002; Huntington et al., 2006). Effective participatory studies emphasize improving trust, and doing so through establishing long-term relationship (Fox, 2002: 23, 48; Huntington et al., 2002; Jolly et al., 2002: 103; Clark and Slocombe, 2005; Huntington et al., 2006; Ford et al., 2008). Since planning workshops are a common method of interaction amongst wildlife management groups in the Yukon, workshops for scenario planning were easily translatable.

In a scenario project intending to result in a large strategic decision, Ralston and Wilson (2006) recommend a project that has 3 workshops of 2-3 days each, with a scenario team of 8-12 participants, and spans 3-4 months (Ralston and Wilson, 2006: 59). 3 workshops were conducted in Haines Junction, YT over a 13 month period.

The first workshop had 9 participants and lasted 1 day in January 2012. This workshop addressed the first question under the first objective, and accomplished scenario development steps 5, 6, and 7 (Appendix A).



The second workshop lasted 2 days in April 2012 and 9 participants attended. 2 participants from the first workshop did not attend the second workshop, but 2 participants joined who were not present at the first workshop. This workshop addressed the second question under the first objective, and accomplished scenario development steps 8, 9, 10, and 11 (Appendix A).

The third workshop happened over a single day in February 2013 and had 6 participants. 7 participants who had attended previous workshops failed to attend the third workshop. 2 individuals who had attended no previous workshops attended the third workshop. This workshop addressed the third question under the first objective, and accomplished scenario development steps 16, 17, 18, and 19 (Appendix A). Participants also discussed how scenario planning might fit into existing wildlife management planning.

For a detailed description of the scenario development process, see Appendix A.

### **Flip Charts**

Researchers used flip charts to record main ideas of conversation threads. They were also used to facilitate several steps of the scenario development process, such as grouping drivers of change into axes of uncertainty.

### **Audio Recording**

Workshops were audio recorded to ensure all input from participants was captured. Researchers used the recordings to evaluate and include input when writing the scenarios. The recordings also helped researchers reattach context to participant input, such as the tone used. Audio was especially helpful for linking back details to main ideas that were written elsewhere, for example on flip charts.

## **Participant Observation**

Researchers kept field notes during workshops. Notes included but were not limited to important participant commentary, details to further research, emerging themes, and tone of participants.

## **Surveys**

Two surveys were conducted, one after the second workshop and one after the third workshop. The surveys addressed the second study objective of understanding perceptions of scenario planning as a tool to develop wildlife management goals. Since the number of completed surveys was small (n=8 for survey 1 and n=6 for survey 2), survey data was coded and analyzed by hand. See Appendix D for survey questions and results.

## **Visuals of Scenarios**

Visually representing themes and local conditions enhances people's ability to visualize future scenarios. This can result in improved decision making by allowing people to more readily think about the implications of a given scenario (Ralston and Wilson, 2006: 202; Sheppard et al., 2011). Researchers worked with a local Yukon artist to represent main themes and important drivers that came from the workshops in a set of four computer-generated images, one image for each scenario (Figure 3.1).

## **RESULTS**

### **Axes of Change**

The scenario team grouped the 46 drivers of change into 3 distinct axes of uncertainty (Appendix B). 18 drivers were grouped into a “Changing Ecological-Social Interactions” axis. 20 drivers were grouped into a “Land Use” axis. 8 drivers were grouped into “The Human Factor” axis. Once axes were selected, participants identified the logics for the axes, or the two polar directions an axis could manifest in the future. The “Changing Ecological-Social Interactions” axis had logics of “unpredictable change” and “gradual change.” The “Land Use” axis had logics of “high cumulative impacts” and “low cumulative impacts.” Finally, the “The Human Factor” axis had logics of “Exploitative” and “Stewardship.”

### **Scenario Logics**

Grouping the various axis logics together yielded 8 possible scenario logics (Appendix C). Writing narratives for 8 scenarios would be unwieldy, and not all of the paired scenarios logics make sense. For example, a scenario in which there are high cumulative impacts from land use, but human values reflecting a stewardship ethic seems contradictory. For this reason, the scenario team deemed some scenario logics less likely to happen and discarded them, leaving 4 scenarios (Appendix C).

### **Scenarios**

The scenario team developed four alternate visions of the future southwest Yukon SES. Full scenario narratives can be found in Appendix F. Brief bullet points of main threads from the scenarios can be found in Table 3.1. Illustrations of main

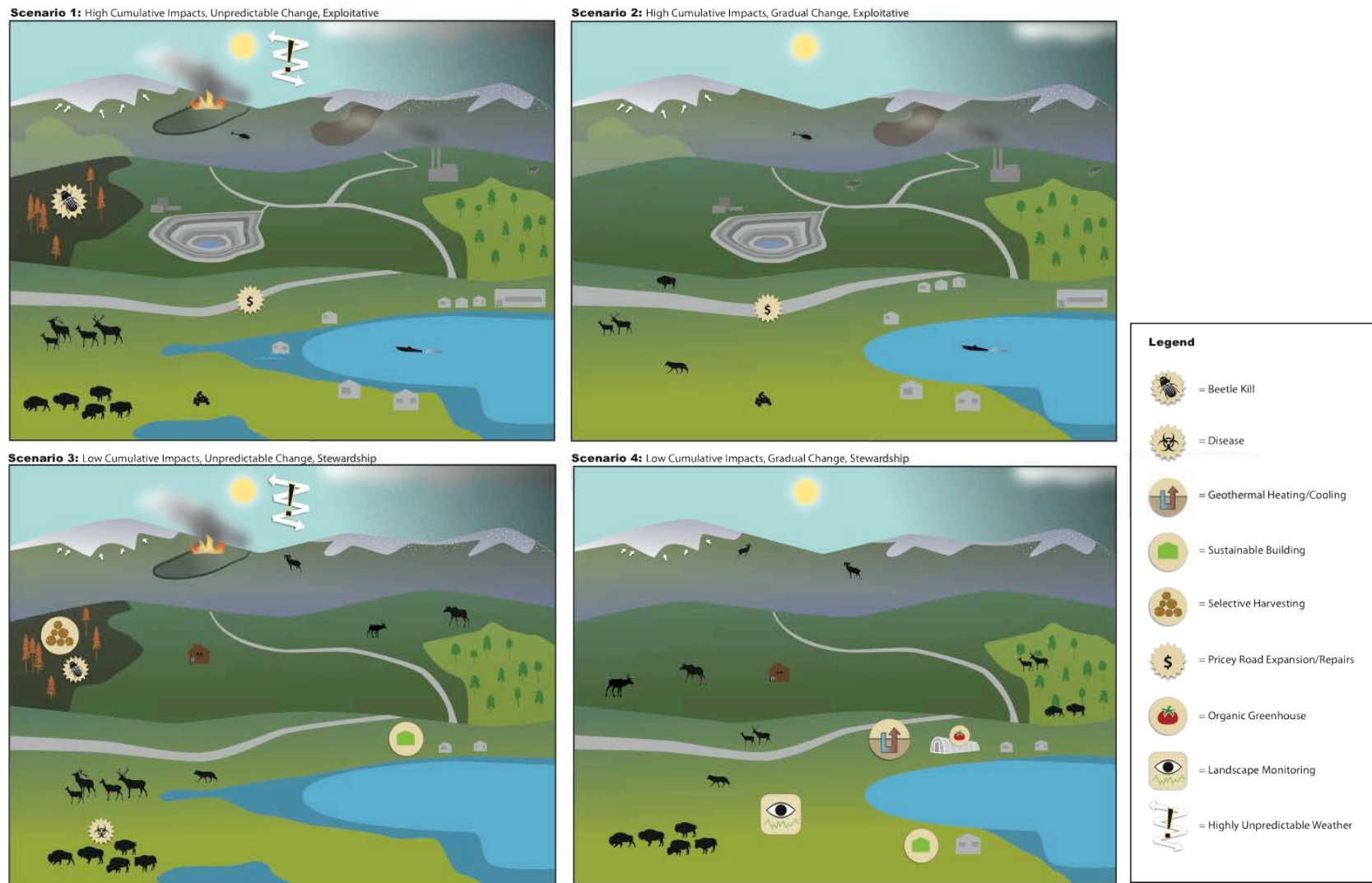
threads of each scenario can be found in Figure 3.1. Key opportunities and threats presented by each scenario can be found in Table 3.2.

### **Opportunities and Threats**

The scenario team identified both opportunities and threats posed by each scenario. Table 3.2 shows 5 opportunities and 5 threats identified for each scenario.

**Table 3.1.** A comparison of the 4 scenarios showing main threads from the 3 axes of change, management actions taken in each scenario, and status of native and new ungulate populations. Full scenario narratives can be found in Appendix F.

Scenario	The Human Factor	Land Use	Changing SES Interactions	Management Actions	Wildlife
1	Unregulated land use, Changing YT demographics, Values resource oriented, Limited connection to land	Coal mine at Division Mountain, Gold Mine in Ruby Range, Expanded Alaska Highway, Land-based economy struggling	Rapidly expanding meadows, Rapid decline in spruce trees, Shortened fire cycle, Intense beetle outbreaks, Harsh winters, dry summers	Intense management of native ungulates, Hunting restrictions on native ungulates, Status quo management of new species	Low native species populations, Moderate new species populations
2	Unregulated land use, Changing YT demographics, Values resource oriented, Limited connection to land	Gold Mine in Ruby Range, Expanded Alaska Highway, Land-based economy struggling	Slowly expanding meadows, Decline in spruce trees, Wet winters, Dry summers	Unintended consequences, Intense native species management, Weak monitoring of new ungulates, Restricted native species hunting, Lottery hunting on new ungulate species,	Low native species populations, Low new species populations
3	Regulated land use, Green infrastructure, Values stewardship oriented, People connected to land	Small mine operations only, Wood pellet energy from selective harvest, Land-based economy okay	Rapidly expanding meadows, Rapid decline in spruce trees, Shortened fire cycle, Intense beetle outbreaks, Harsh winters, dry summers, Disease in wood bison herd	Unintended consequences, Restricted native species hunting, Wolf sterilization program, Selective forest harvesting, Management shift to wood bison and elk	Low native species populations, High new species populations
4	Regulated land use, Green infrastructure, Values stewardship oriented, People connected to land	Small mine operations only, Greenhouse farming, Geothermal heating and cooling, Land-based economy thriving	Slowly expanding meadows, Decline in spruce trees, Wet winters, Dry summers	Intense management of native and new species, New species ranges restricted, Wolf sterilization program	Low-Moderate native species populations, Moderate new species populations



**Figure 3.1.** Illustration of the 4 scenarios. The illustration highlights major themes and events within each scenario. The figure legend defines the symbols within the illustration. Full scenario narratives can be found in Appendix F.

**Table 3.2.** Key opportunities and threats associated with each scenario.

	<b>Scenario 1</b>	<b>Scenario 2</b>	<b>Scenario 3</b>	<b>Scenario 4</b>
<b>Opportunities</b>	<ol style="list-style-type: none"> <li>1. Increased opportunity for monetary gain, which can help people adapt to changes.</li> <li>2. Can implement stronger mitigation measures to protect wildlife populations from development.</li> <li>3. Can implement regular monitoring of native ungulate populations with management actions triggered at certain population thresholds or trends.</li> <li>4. Shift harvest to bison, elk, and deer since more adaptable and abundant.</li> <li>5. Crisis, although reactive, can force meaningful management actions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Increased opportunity for monetary gain, which can help people adapt to changes.</li> <li>2. Gradual change allows time to mitigate or adapt to climate change.</li> <li>3. Time to acquire baseline data.</li> <li>4. Gradual change allows time to focus on desired management outcomes.</li> <li>5. Can shift some of the harvest to species such as wood bison, elk, or mule deer.</li> </ol>	<ol style="list-style-type: none"> <li>1. Work with nature to manage adaptively since wild still exists.</li> <li>2. Can plan/manage better because public has longer stewardship vision.</li> <li>3. Manage wildlife equally to provide adequate numbers for all.</li> <li>4. Recruit habitat for future caribou and moose habitat by restoring beetle kill harvest.</li> <li>5. Study role of predators in controlling newer ungulate populations.</li> </ol>	<ol style="list-style-type: none"> <li>1. Healthy, sustainable living.</li> <li>2. Investing in renewable resources i.e. solar panels, can reduce greenhouse gas emissions.</li> <li>3. Gradual changes allow time to monitor. Management can be directed towards desired outcomes.</li> <li>4. Changes may favor non-native species such as bison, elk, and deer.</li> <li>5. Opportunity to manage species without being in a recovery situation.</li> </ol>
<b>Threats</b>	<ol style="list-style-type: none"> <li>1. Wildlife habitat changing too fast for native species to adapt.</li> <li>2. Increased mining and commercial activities - increased accessibility of wildlife habitat.</li> <li>3. Less traditional hunting as a result of lower populations of moose and caribou.</li> <li>4. Management is reactive. Actions are too small, too late.</li> <li>5. Changes to lifestyle and demographics.</li> </ol>	<ol style="list-style-type: none"> <li>1. Impacts from wood bison moving into Ta'an Kwäch'an Council Traditional Territory</li> <li>2. Increased cumulative impacts associated with increased developments.</li> <li>3. Loss of wildlife causing land to be less valued and respected by local people.</li> <li>4. High expectations and political pressures for allocating big game species. More difficult environment for cooperative management of wildlife.</li> <li>5. Increased pressures on low wildlife populations.</li> </ol>	<ol style="list-style-type: none"> <li>1. Prioritizing and intensively managing one species at detriment of others.</li> <li>2. Increased disease and parasites.</li> <li>3. Small economy but increased expenses.</li> <li>4. Climate change and management actions changing habitat composition to one less suitable for native species.</li> <li>5. Natural systems may be close to thresholds.</li> </ol>	<ol style="list-style-type: none"> <li>1. Pressure on native species due to climate changes and human infrastructure.</li> <li>2. Adapting to landscape changes.</li> <li>3. Struggling native wildlife populations</li> <li>4. Misperception that wildlife populations are all fine. Wildlife may become less coveted and management and monitoring could become less of a priority.</li> <li>5. Expectations of management may be too high to maintain into the future.</li> </ol>

## Management Goals

A total of 35 management goals were developed for the 4 scenarios. After being grouped by similarity, 7 management goal clusters resulted (Table 3.3). Goal clusters A and F had the highest numbers of goals making up their cluster and had goals related to all three new ungulate species. Goal cluster F applied to all 4 scenarios.

To provide ways to work towards the identified management goals, participants identified 78 total management recommendations. There were 41 total monitoring needs identified, as well as 31 total gaps in programs, partnerships and resources necessary to achieve the identified management goals. Summary tables for each species can be found in Appendix E.

**Table 3.3.** Shows the 7 management goal clusters, each of which contains 1 or more individual management goals grouped by similarity. The table also shows the species and scenarios addressed by each management goal cluster.

Management Goal Cluster	# of Goals	Species	Scenarios
A. Favor native species, limit distribution of new species.	7	Wood Bison, Elk, Mule Deer	2, 3
B. Limit deer expansion	1	Deer	1
C. Adapt to change through co-management	5	Wood Bison, Elk, Mule Deer	2
D. Bison and elk rock	3	Wood Bison, Elk	1, 3
E. Status-quo for deer	2	Mule Deer	1, 4
F. Keep new ungulate species at socially tolerated, harvestable levels	14	Wood Bison, Elk, Mule Deer	1, 2, 3, 4
G. Increase profile/use of new species for food security	3	Wood Bison, Elk, Mule Deer	2, 3



## **DISCUSSION**

The scenarios here do not represent every possible future. Rather, the four scenarios are a subset of the limitless possible futures. The scenarios generated here are not likely to materialize exactly as described. Furthermore, the high level of uncertainty inherent in the future stipulates that the four scenarios are equally probable (Alcamo et al., 2005). These scenarios were chosen for their ability to highlight important causal relationships between driving forces in the southwest Yukon SES.

### **Lessons for Wildlife Management**

#### **Management Goals**

Focusing on goal clusters A and F, the two goal clusters with the most individual goals grouped, we see that new species can provide avenues to adapt to future food security challenges. Goal A is to favor native species while limiting the distribution of new species (Table 3.3). It looks to manage new ungulate species in a manner that will promote the conservation of native ungulates. The goal recognizes the social and economic interest of Yukoners in maintaining native species populations. At the same time, the goal seeks to avoid unintended consequences of prioritizing management on native ungulates at the expense of new ungulates. Perhaps most significantly, the goal acknowledges that new ungulates may need to have a significant role in a transformed SES.

Specific management recommendations would be to minimize overlap between new and native ungulate species' ranges, increase hunting access to new species, disease test, educate about the new species, and create baseline data. In

order to accomplish these recommendations, managers need to monitor new species population trends and distribution, habitat needs, and disease prevalence amongst new species' herds. Resources available to develop new monitoring programs and staff veterinarians, are examples of gaps to reaching management goal A (See Tables A.E.1, A.E.2, and A.E.3, in Appendix E).

Goal cluster F is to keep new species at socially tolerated, harvestable levels (Table 3.3). This goal focuses on the social expectations of managing wildlife. Social toleration occurs in delicate balance. In relation to the Aishihik Wood Bison Herd, it has components of minimizing damage to property, mitigating infringement on cultural practices, while having a population that supports a harvest (Clark, 2011). Perhaps most significantly, the goal acknowledges the role that new ungulate species can have in alleviating hunting pressures from native species.

Specific management recommendations include, manage potential impacts of new species on native species, mitigate human-wildlife conflicts in areas such as road crossings or commercial elk or bison farms, expanding hunting opportunities, and including new ungulate species as subsistence species to improve First Nation toleration and/or use. To ensure social toleration, the public needs to know what impacts the new species are having, if any, on the native species. Therefore there is need of monitoring interactions between new and native species, interactions between new species and people, population size, distribution, and trends of new species, as well as the prevalence of disease in new species populations. Resources dedicated to monitoring new ungulate species, understanding of new species' impacts on other species and the landscape, and that there is no existing

management plan for mule deer are gaps to accomplishing goal F. Given the social and ecological underpinnings of this management goal, an understanding of how to accomplish it can only come from mixed science and social science approaches (See Tables A.E.1, A.E.2, and A.E.3, in Appendix E).

### **Value and Species**

This study revealed that there might be many factors influencing the value society attributes to new species in the future. Main factors identified in this study include disease, status, context, and food security. With respect to disease, warming from climate change will open pathways for new viruses and parasites to which southwest Yukon ungulates are unaccustomed (Parmesan, 2006). Mule deer dispersing into the southwest Yukon represent a vector of transmission for southern parasites (Parmesan, 2006). To help mitigate impacts from disease, monitoring needs to be regularized with a permanent budget. Yukon Territorial Government needs staff veterinarians and should require mandatory tissue submission from hunters. In futures with a higher volume of extractive industry, increased tax revenues could support such efforts. In scenarios with a lower volume of extractive industry, YTG could reprioritize resources to meet management needs.

### **Status**

Participants noted that people's value of the new species will likely be influenced by the species' status of introduction. Elk were clearly introduced, while bison were reintroduced and mule deer are moving in on their own. Therefore, Yukoners may be more amenable to having large populations of bison and mule

deer as opposed to elk. Wood bison, however, have complications such as their large size, potential for property damage, and unknown degrees of competition with other species (Clark, 2011).

Mule deer on the other hand have far less associated “baggage” than do bison or elk. They tend to have smaller herd sizes, do not compete with caribou or moose for habitat, are less likely to damage property, and are dispersing naturally. For these reasons, it may be easier for people to accept them being on the land. Disease is the single largest concern with regards to mule deer, especially concerning transmission to caribou or moose.

### **Context**

This study demonstrated that the value of a species to society might change depending on the varying context of the scenarios. In scenarios 1 and 2 where people have an exploitative ethic, participants described the wage economy having shifted people’s ecological values. They are spending less time on the land and the time that is spent is less rich. Wage earners who only have a few days off will likely spend it hunting a species where they have a higher probability of success rather than going after animals that have a small population.

Conversely, in scenarios 3 and 4 people have a stewardship ethic with strong ecological values. These people may be looking for opportunities of extended exposure to the land to improve their connection. Hunting animals in smaller populations may be less of an issue under these scenarios, and so caribou and moose might remain highly valued from a hunting perspective.

## **Food Security**

The essence of many conversations during the workshops was to food security, which is a focal issue in the southwest Yukon. Throughout the workshops participants voiced concerns over having socially acceptable numbers of animals of different species. Socially acceptable, in part, meant managing impacts on the landscape and to property, but was primarily centered around maintaining a harvest. Many Yukoners hunt and trap as a way to connect culturally to the land, reap economic benefits, or simply as a lifestyle choice.

All four scenarios showed futures of declining populations of culturally and economically important ungulates. Culturally, this could mean further disconnect from traditional lifestyle, a concern among many First Nations. Without wildlife such as caribou and moose, there is a fear that it will be harder to maintain a traditional lifestyle, and that time spent on the land will be less rich. Economically, this could mean that living from the land is less viable in the future. Those who survive from land-based economic opportunities such as outfitting or trapping may not be successful enough to survive on these activities alone. Demand for wage jobs could increase in response.

A desire to maintain a harvest reveals that people value species they can hunt. This indicates that availability will dictate resource use and therefore values. In scenarios where native species population sizes are low, participants recommend that new species be managed to viable and huntable populations. Conversely, in scenarios where native species populations are healthy, participants recommended for new species ranges to be restricted and population sizes kept low,

predominantly through harvest. This shows participants recognizing the new species as important in terms of food security. The new species represent opportunities to hunt as well as remove hunting pressures from caribou and moose. Secondly, it means that if management is unable raise population levels of native species, then there may be an opportunity for a shift in management priorities in order to preserve a harvest.

Caribou seem to be highly affected by climate, as indicated by unstable, cyclical fluctuations in population numbers (Lee et al., 2000). Extreme weather events, such as freezing rain in spring or late snowmelts, can severely affect caribou calf survival (Lee et al., 2000). Future weather in the southwest Yukon is predicted to be highly variable (Ogden and Innes, 2009), which could further reduce likelihood of caribou being a reliable food source in the southwest Yukon. Despite a bleak future outlook, if caribou and moose can still provide food and cultural opportunities for people it is likely that those species will retain a majority of management attention.

Wildlife management has to contend with societal expectations, which may or may not align with prioritizing management dollars to species that have the best chance of succeeding under future conditions. However, there is also the possibility that caribou and moose will retain significant wildlife management attention regardless of the scenario due to having high cultural value. The likelihood of management success may be low in the future but that does not preclude management attempts if people's expectations of management are rooted in protecting culturally important species.

According to workshop participants, with the slow shift from caribou use to moose use in the late 1800s, people's values shifted accordingly to where moose became a culturally important species. At the moment, wood bison provide the most opportunities for hunting of any ungulate species in the southwest Yukon. Through hunting, bison provide valuable opportunities for people to be on the land, which is culturally important for First Nations, as well as harvest meat. Several community bison hunts are organized each year, including by the Elijah Smith Elementary School and the Champagne-Aishihik First Nations Department of Heritage, Lands, and Resources. These events provide opportunities for people, and especially young people, to get out on the land, help hunt, and interact with bison. A young Champagne-Aishihik First Nations child may have never before hunted caribou since recent First Nation hunting levels on the Aishihik Caribou Herd have been voluntarily low, yet that child may have hunted bison on a community hunt. These experiences will affect how people value species, particularly bison, in the future.

Hunting, herding, fishing, and gathering activities link people's histories to their contemporary cultural settings (Nuttall et al., 2005; Wenzel, 2009; Ford et al., 2010). Today, hunting activities are determined to a large extent by resource management regimes and land use and land ownership regulations. Indigenous peoples are no longer able to move as flexibly in response to shifts in their resource base (Wenzel, 2009). Subsistence hunting communities that rely on multiple species will likely be more adaptive towards possible future landscape conditions (Nelson et al., 2008). If indigenous people want to maintain a culture of hunting and having country food as a large portion of their diet, they will need to be flexible in the

species that they are willing to harvest (Nelson et al., 2008). This is not a new concept, but it reinforces a potential need for people to be open-minded about harvesting the new species.

Having the option of multiple species to hunt will be important as changes to the southwest Yukon social-ecological system occur. This is significant since, in all of the future scenarios, bison populations remain one of the most stable populations and will likely yield the most hunting opportunities. Future conditions illustrated by the scenarios indicate high potential need for a cultural shift to occur to the new species, provided people are given avenues to build a cultural and economic appreciation. Changes in how new species will be exploited or allowed to grow will be dependent on the value society holds for them. Opportunities to hunt the new species could foster appreciation and value for them, illustrating the power of management in the Yukon.

### **Management Discretion**

The 4 scenarios showcase how wildlife management can have a high impact on southwest Yukon species composition, whether intentionally or unintentionally. They can serve as a mechanism to examine potential unintended consequences. They offer warnings to wildlife managers and suggest opportunities for proactive management decisions. Wildlife managers need to think carefully and holistically about how to manage the new species in order to maintain options in the future. As participants said, when it comes to caribou or moose management can likely only



affect a small change. However management actions can have a big effect right now on whether bison, elk, or mule deer populations are small or large (Table 3.1).

Through management, doors can be opened or shut for species' future. For example, enacting restrictive or destructive policies towards mule deer today may result in a reduced mule deer population in a future where mule deer would be valued. This could happen if other species responding poorly to changing pressures (Table 3.1). Wildlife management should therefore avoid overharvest of the new species, and should focus on maintaining population sizes at socially and ecologically acceptable levels (Table 3.3, management goal F). Ungulate populations in general in the southwest Yukon are fairly small and overexploiting the populations through hunting will make the species increasingly susceptible to environmental changes. This is echoed as a threat in scenario 2 (Table 3.2).

The scenarios bring to light some examples of possible consequences of not thinking through management actions. Scenario 3 demonstrates poorly planned selective harvesting (Table 3.1), which stimulated a conversion of habitat suitable for native species to habitat suitable for new species. This displayed management's ability to aid the directional change of the environment, but unintentionally and at the expense of the culturally sensitive native ungulates.

Inaction is also a form of action. Scenario 2 represents a future in which there was time to adjust to the changing system (Table 3.2), but management had reacted too slowly. Overexploitation of new ungulates saw that harvest sustaining population thresholds were not met and so new ungulates populations remained low (Table 3.1). By utilizing the scenarios, managers can weigh policy options

against possible outcomes (Wollenberg et al., 2000; Peterson et al., 2003) and avoid the costs of inaction seen in scenario 2. Scenario 3 saw the Aishihik Wood Bison Herd compromised by Brucellosis (Table 3.1). More vigilant disease screening may have prevented this occurrence. With increased disease as a threat (Table 3.2), wildlife managers can increase their disease monitoring by testing more hunter submissions.

It is important for wildlife managers not to become discouraged when faced with complex problems. Wildlife managers can't control the weather or which companies have mineral rights, but they can influence policy, land use, research, and wildlife management decisions. Setting harvest limits and management priorities will directly impact the composition, abundance, and densities of flora and fauna species in the future.

### **Education**

Wildlife managers can influence societal values by educating the public of the value of each species. Native ungulate populations were low in all 4 of the scenarios (low-moderate in S4), possibly indicating futures of poor hunting opportunities of the native species. Participants noted the importance of educating the public about alternative hunting opportunities as a way to remove hunting pressure from native species. Human hunting pressure is one source of pressure on wildlife that wildlife managers can control. Through effective education programs, wildlife managers could proactively relieve human hunting pressures on native ungulates. In order to achieve public acceptance of hunting the new species wildlife managers will need to

increase the new species' profile (management goal cluster G, Table 3.3), of which education will be a crucial component.

An important point of consideration is how First Nations did not have a transitional period in which they could get used to wood bison. First Nation people only saw them inside a pen for two years in the Nisling River Valley before they began to be released. The most recent natural transition to a new subsistence species occurred with moose. First Nations people were able to slowly begin hunting moose as caribou became less abundant. The transition was less abrupt than the appearance of bison. Building familiarity and comfort can take time, which can be accelerated by educational opportunities that expose people to the new species.

### **First Nation capacity**

First Nation participants expressed a concern for the ability of First Nation Governments to address current and future needs presented by the scenarios. Of particular worry is First Nation capacity to perform additional species and disease monitoring. This study highlights an opportunity to increase knowledge sharing between First Nation governments and other Yukon Territory institutions. In conditions of rapid change institutions will be plagued by bounded rationality (Kofinas, 2009), a term used to “designate rational choice that takes into account cognitive limitations of the decision maker” (Simon, 1982: 291). The adaptive management paradigm recognizes that sustainable management strategies are made when stakeholders forge new relationships. New relationships help to

enhance multi-directional information flows and develop flexible ways of managing their environments (Carpenter and Gunderson 2001). Additionally, the need for more information underlines an opportunity to recognize and utilize other ways of knowing.

A diversity of perspectives is required for understanding complex systems (Berkes et al., 2003; Pahl-Wost and Hare, 2004; Armitage et al., 2007; Kay, 2008). Combining different types of knowledge for learning can interact across temporal and spatial scales. It is a critical factor for dealing with social-ecological dynamics during periods of rapid change and reorganization (Folke et al., 2005).

However, a diversity of perspectives can mean many things. Cultural diversity has value because it provides a diversity of perspectives and experience on ways to meet goals in a changing future (Chapin et al., 2009). Elders in many societies remember ways of doing things under a range of circumstances, which can enrich the options available to address changes. Traditional indigenous management strategies provide managers with alternative options to consider (Chapin et al., 2009; Gadgil et al., 2003). Studies have demonstrated the usefulness of other knowledge systems in expanding the information base. A comprehensive study with the Chipewyan Dene led to improved understanding of changing barren-ground caribou movements (Parlee et al., 2005) and body condition (Lyver and Dene First Nation, 2005).

This paper does not intend to address existing debates about traditional ecological knowledge (TEK). Rather, it argues that wildlife managers will need all available information in the future to come, and that TEK is information. There are

gaps in the current decision making process for directly including TEK and local knowledge (Tsuji and Ho, 2002; Nadasdy, 2003; McGregor, 2008), despite suggestions from researchers of its value (McDonald et al., 1997; Krupnik and Jolly, 2002; Moller et al., 2004; Brook and McLachlan, 2008; Clark and Slocombe, 2009; Ogden and Innes, 2009). Qualitative, participatory scenario planning provides a mechanism to incorporate TEK and local knowledge into a planning process.

### **Adaptive, longer-term management plans**

Workshop conversations reinforced other findings that conventional approaches to wildlife management planning are insufficient under today's conditions of rapid change (Gibeau, 2012; Chapin et al., 2009; Kofinas, 2009; Kay, 2008; Lister, 2008; Armitage et al., 2007; Berkes et al., 2003). There was a widespread feeling amongst participants that "management plans are dated as soon as they go out the door." Others felt that wildlife management planning in the Yukon Territory is loosely based around the principle of "the squeaky wheel gets the grease." These quotes reinforce some participants' concerns of Yukon wildlife management being shortsighted and reactive.

The current wildlife management planning that produces plans based on a 5-year period lacks long-term vision. Though the cycle of reevaluating management plans after 5 years is meant to be adaptive, each reevaluated plan is short term in scope without an over-arching long-term vision. There is a need for wildlife management to incorporate planning occurring at longer time scales. Currently, there is no mechanism in place that allows for this. The scenarios, however, look 20

years into the future and allow managers to plan around a holistic view of the system.

Participants stated that wood bison management could have benefitted from having done a scenario planning process. Had the YWBTT had access to the scenarios, Tech Team members could have developed management recommendations for if the bison growth rate outpaced the harvest rate, or alternatively, developed defined harvest goals to keep the bison herd in check. Bearing this lesson in mind, with the absence of a mule deer management plan, there is an opportunity to develop management goals for deer based on multiple long-term views of the future. Utilizing the scenarios from this process, wildlife managers can have contingency plans in place for mule deer as the various futures begin to unfold.

According to Champagne-Aishihik resource managers, they have held off creating a new Traditional Territory management plan. They view using a broken process as counterproductive and want to avoid generating a document that would not meet the First Nation's needs. A scenario planning process could help the First Nation resource managers to generate missing holistic and long-term management goals.

In terms of scenario planning, an unwillingness to go beyond conventional views promotes a tendency to interpret the unknown future in terms of the known past (Ralston and Wilson, 2006: 202). This limits creativity and a scenario team's ability to imagine uncertain elements of the system.

#### Box 4.1 Summarized Lessons for Yukon Wildlife Management Practitioners

##### Content Lessons:

1. Several factors might influence the value society attributes to new species, including disease status, introductory status, future context, and food security implications.
2. Today's management actions will have serious implications for the population levels of tomorrow's new ungulate species.
3. Providing hunting and education opportunities might influence society's value of new species
4. A desire of Yukoners to maintain a harvest represents an opportunity for wildlife managers to facilitate the valuing of new species.
5. Disease will likely factor prominently in the future. Increased monitoring for various ungulate diseases is necessary.

##### Process Lessons:

1. Improved knowledge sharing represents a way to increase First Nation government capacity.
2. There is a need for longer-term wildlife management planning processes to accompany existing planning processes.
3. Planning should include holistic thought processes that consider how driving forces might interact into the future.

### Lessons for Scenario Planning

This study found several practical lessons for future users of scenario planning. Participants described scenario planning as a method that enabled broad thinking and the sharing of perspectives. They also shared ways to improve the clarity of the process and potential future applications for scenario planning in the Yukon. Researchers found having a group with diverse experience and perspectives to be important.

#### **Broad Thinking**

Systems thinking changes the goal from seeking knowledge of parts of the system to improving understanding of the dynamics of the whole system (Folke et

al., 2005). Participants mentioned how the holistic, ecosystem approach that considered species, human needs and values, and development helped them to visualize the effects of non-ecological components of the SES on wildlife. When the thinking was centered on how interactions between drivers form causal relationships, participants were able to visualize potential threats that may not have been discussed in southwest Yukon wildlife management circles. Perhaps the most significant awareness that rose through the scenario planning process was potential unintended consequences of using management to “close the door” on one or more of the new species.

Participants valued how the scenario planning process encouraged and required broad thinking, described as “different,” “integrative,” and “long-term.” All participants agreed that the long-term nature of thinking in scenario planning is something generally missing in conventional wildlife management planning.

The collaborative aspects of the process enhanced people’s ability to think broadly. Participants viewed collaborative discussion as helpful while identifying drivers of change, during visualization of future scenarios, and thinking about how forces might interact in the future. By discussing these elements in groups after periods of independent thinking, scenario team members were able to draw from each other’s perspectives and experience with the system. This led to visualizations that may have been more plausible and far-reaching than if they had undertaken the exercise solely as individuals. Discussion served to expand creativity and check improbable notions of the future.



It also proved important for scenario team members to be well versed with the defined SES. Experience tended to reference either an individual's own experiences or experiences of the collective group. Used here, experience means life experience or work experience. Participants found that having participants in the group with diverse and extensive experience related to the decision focus helped to facilitate the scenario planning process. More specifically, having participants with a wealth of experience working and living in the southwest Yukon SES helped to think broadly to identify a wide range of drivers of change.

### **Perspectives and Values**

Giving voice to diverse perspectives is a value of scenario planning (Peterson et al., 2003). It is important to have participants with diverse perspectives represented during the scenario development process (Ralston and Wilson, 2006: 103). These perspectives might include economic, social, or cultural. Having more values or perspectives present could make consensus harder to reach at various points of the scenario planning process. However, having a wide variety of values and perspectives can help to identify more possibilities of how the system might change in the future. In this study, having both First Nation and western cultural perspectives present influenced the conversation about how to group drivers of change into axes of uncertainty. Again, these two perspectives resulted in varied management goals.

In this study, all survey respondents agreed that scenario planning is a method that could help people with different perspectives collaborate and discuss

issues (Table A.D.1.). Similarly, 88% of survey respondents agreed that the scenario planning process helped to understand points of view of other stakeholders (Table A.D.1.). These two findings indicate that scenario planning could be a useful tool to find consensus common ground between stakeholders with differing perspectives and values.

### **Clarifying the Process**

Throughout the scenario planning process, participants reached points where they needed clarification. Being a very systematic process, participants sometimes felt unsure of how the sum of the parts would add up to the whole, or what even the whole was. This served as a lesson to explain the full extent of the process to participants at the beginning. It was evident that knowing how each step of the process worked towards the ultimate goal helped participants perform each step.

For example, the 8<sup>th</sup> step in the scenario planning process of ranking drivers (see Appendix A) caused confusion. Multiple participants found issues with scale, feeling that some drivers could be nested within other drivers. Mining exploration and production, for example, both fit within the larger driver of natural resource demand. By ranking one as higher impact than the others, would they necessarily reduce the importance of the others that are related? Grouping similar drivers prior to ranking the drivers could reduce confusion of scale when ranking.

Similarly, when asked to identify drivers of change, some participants wanted clarification about what the drivers were to be used for, or how general or

specific the drivers should be. Seeing examples from other scenario planning workshops was helpful and is recommended.

### **Context**

Literature on the scenario planning process recommends identifying strategies or goals that can be applied across multiple scenarios. These strategies would be considered resilient or flexible (Ralston and Wilson, 2006: 149). In forest management workshops looking at different climate futures, participants looked for “no regrets” strategies. These were strategies that could work under multiple possible climate futures and would therefore be considered robust strategies (Ogden and Innes, 2009). We found, however, that in a wildlife management context participants were reluctant to sort wildlife management goals in this manner. It was important to the participants that they keep goals fixed in the contexts of individual scenarios; the reason being that management needs would be different in different futures.

Table 3.3 indicates that five of the seven goal clusters could be applied across multiple scenarios. However, different management recommendations were made to achieve the goals under the varying contexts of the scenarios. For example, it is a goal to keep new species at socially tolerable, harvestable levels in all four scenarios. However, the individual steps to maintain wood bison populations would be different in scenario 3 where disease is prevalent in the population than in scenario 1 where the population is disease free. The social tolerance for wood bison could be

much lower in a scenario where the herd has disease. It is important not to lose the aspects of a clustered goal that root it to the conditions of a specific scenario.

A separate point still relating to the importance of context, the narrative or story format of the scenarios helps create a hypothetical situation that may remove participants' personal attachment to the day-to-day situations. By removing some of the personal investment, the process provides a less provocative way to talk about the familiar issues. This may contribute to why participants felt that scenario planning could be a helpful method for stakeholders with diverse perspectives and values to discuss complex issues (Table A.D.1.).

### **Application**

Scenario planning has a potential for wide applicability in wildlife management. Participants found scenario planning helpful to set priorities for wildlife management, raise awareness of potential threats, identify future monitoring and resource needs, examine long-term repercussions of management actions, stimulate the sharing of perspectives, and building capacity. Participants also mentioned that scenario planning could be particularly useful if generating a wildlife management plan, a species recovery document, land use planning, or when conducting risk or resilience assessments. It was mentioned, in retrospect, that Yukon wood bison management could have benefitted from a scenario planning process.

Participants also saw potential value in applying the scenarios when considering management for other species and/or resources within the same

system. This is an important finding. Scenarios narratives describe several versions of the future system with a focus on a particular element. However, groups interested in focusing the scenarios on a different element, say wolves or coniferous forests rather than new ungulates, can use the bones of the scenarios since they were built considering the system holistically. The causal relationships considered during the original scenario development process will still apply. They simply need to be re-focused as to how the resulting events could implicate the newly emphasized element.

### **Lessons about Process**

#### **Time**

Latency posed a problem. Significant time between workshops led participants to forget the meaning and context behind drivers of change. Participants also had difficulty remembering fine details of the scenarios by the time they were discussed. This could be avoided by keeping to the recommended timetable of 3-4 months (Ralston and Wilson, 2006: 59), with roughly 1 month between each workshop. This puts significant pressure on the scenario narrative writer, but reinforces the scenario team members' memory of workshop events and context.

Also, ensure enough time has been given for all scenario planning steps to unfold. In this process, participants felt that there needed to be more time to develop and discuss management goals. Furthermore, because the third workshop was only a single day there was no time to develop indicators. As a result, this

planning process is missing an aspect fundamental to operationalizing the resulting management goals. Building adaptive capacity suffered.

### **Definitions**

A second problem was that at times participants were working with a different set of definitions. People's interpretations of words differed, likely due to varying cultural or professional understandings. A particular issue was how to define the word uncertainty with reference to the drivers of change. Some participants took it to mean uncertainty of occurrence, while others thought it to mean uncertainty of impact. This may have caused a different interpretation of how to rank the drivers.

As this scenario process was rooted in SES theory, the researchers constantly referred to "the entire system". What exactly was entailed in "the entire system" gave participants trouble. For some thinking system-wide, or holistically, was problematic. These participants had trouble combining aspects of the human economy and environmental interactions into the same thought. Others already had an operationalized understanding of what it means for an environment to also contain human social and economic interactions. This difference in understanding challenged conversations about how to group drivers and talk about how drivers might interact into the future. This also highlighted a benefit to scenario planning of challenging people to understand each other's perspectives and values.

### **Continuity of participants**

Continuity of workshop participants was also a problem. As this was a voluntary study, participants were not obligated to attend. Coordinating a time

when all participants were available was challenging, and ultimately was unsuccessful. Several participants did not attend all three workshops. Some participants lost interest after the first workshop, while some people gained interest and came to subsequent workshops. Participants who attended only the final workshop were missing context from the previous workshops and seemed to have trouble adjusting to the kind of thinking required.

If conducting scenarios workshops with a small scenario team, ask participants to commit to all workshops if possible. This will ensure continuity of the participants and the represented perspectives. More robust management goals are possible from a scenario team that understands the context from the entire scenario development process. Workshops done within an institution with employees whose job it is to attend would not suffer from the same problem.

#### Box 4.2 Summarized Lessons for Scenario Planning Practitioners

##### Content Lessons:

1. Management goals are attached to the context of each scenario.
2. Scenario planning can help resource managers identify needs that have gone unfunded but may be important in the future.
3. Scenarios could be used to develop management goals for other resources within the same system.
4. Scenario Planning provides a way to use traditional knowledge and local knowledge in a planning process.
5. Scenario planning can help people with different perspectives collaborate and discuss issues.
6. Scenario planning can foster an understanding of others' points of view.

##### Process Lessons:

1. Carefully define important terms, such as uncertainty and system.
2. Describe each step of the scenario planning process, and how each step contributes towards the development of the scenarios.
3. Reduce confusion of driver scale by categorizing the drivers prior to ranking.
4. Ensure continuity of workshop participants.
5. There should be no longer than one month between workshops.

## **Calls for Action / Recommendations**

### **Towards a food secure future**

The scenarios feature opportunities to shift hunting to bison and elk, thereby removing pressure from caribou and moose. The scenarios remind us that this needs to be done carefully to avoid unintended consequences. Proper monitoring of wood bison, elk, and mule deer populations needs to be done to ensure that the populations can continue to support a harvest. Should managers and decision makers decide to reposition resources to aid this transition, educating the public will be critical. Public acceptance of new management priorities could take time, but could be accelerated through incentives, such as affordable hunting tags, which



permit the harvesting of an individual animal. Improved hunting opportunities will likely not result in social tolerance for every segment of the population. Therefore, wildlife managers will need to find other creative means to communicate the importance of having the new ungulates on the landscape.

The scenarios emphasize that the future may be one without species that have been culturally and economically important for generations. Shifting hunting and cultural use to new species may be about having species available to use at all, and not just about reducing hunting pressure. A central question for Yukon wildlife managers to grapple with right now is, will spending a majority of resources on moose and caribou get Yukoners where they want to be in 20 years? If new species thrive in future scenarios will people value them? How can wildlife managers help to cultivate value of these species, and thus secure food security for the region?

### **Room for parallel planning?**

Participants voiced a need incorporate slower, long-term and integrated planning into the wildlife management planning process. Scenario planning could be used complementarily to existing management planning processes. It provides a mechanism to connect short-term operational goals with long-term goals 20 or more years in the future. Mid-term review mechanisms, or indicators, can be developed that show the need to adapt or redirect management towards long-term goals. It is true that adding another thought process would add work to already resource-stressed wildlife managers. However, looking holistically at all of the elements needing management could result in more efficient resource allocation.

Scenario planning can be used as a foundational process towards SES-based management goals. Undertaking this thought process can help wildlife managers plan wildlife management goals with a deeper understanding of a goal's implications to the rest of the SES. Identifying the drivers and goals to determine where we might be headed can lead to proactive management, rather than reacting to what needs the "grease." Planning more holistically, and improving interdepartmental information flows, could reduce competition for resources to manage individual species. For these reasons, participants felt that instilling a culture of going through these types of processes before planning would be extremely useful.

Findings from this study show that scenario planning is a valuable tool for resource managers. It offers ways to devise longer-term, holistic management goals attached to indicators. Using this method can improve the flexibility of management regimes, thereby enhancing adaptive capacity to rapid change. Since resource management is inextricably connected to the nested societal dimensions, one of scenario planning's most significant contribution is a forum for people to share perspectives and develop trust and understanding of one another. Major resource management plans and/or resource development projects in the future should consider using a scenarios approach to better articulated goals in terms of the impact on the whole system. Doing so might lead to a more considerate, sustainable future.

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## **TRANSITION**

This section is intended to transition between the manuscript chapter and the concluding chapter. The main goal of the concluding chapter is to link the manuscript's findings back to the literature identified in the introductory chapter. I do this primarily by expanding upon ideas of how scenario planning can advance theories within the social-ecological systems, adaptive governance, and resilience literature.

I begin the chapter by reflecting on my graduate student experience, paying special attention to how my thoughts have developed throughout the process. I then discuss how findings from this work improve adaptive capacity through learning, enhance institutional linkages, and can be used to plan for social-ecological system transformation. These are each areas I would like to explore further and from which I would like to build publishable papers. I continue by discussing how southwest Yukon wildlife management, and wildlife management more broadly, should focus on building more inclusive approaches to goal development. I end by providing examples of indicators for the scenarios, since we unfortunately ran out of time to do so during the workshops.



## CHAPTER 3: CONCLUSION

### CONCLUSION

#### Reflection

In reflection, my journey through the scenario planning workshops helped me to arrive at more questions than answers—as all good projects should. Life is not about answering questions. And that is fine, because we learn from the process and not a self-determined ending. Process, then, is everything.

When looking for graduate degree programs I had a goal to broaden my understanding of wildlife ecology and management from a dominantly ecological perspective to a perspective that married ecology and policy. More than that, I wanted to learn about values and how they influenced the production of wildlife policies, or alternatively, how might policies fail or succeed relative to local values.

Therefore, when I set out to develop a project from Dr. Clark's funded proposal, I wanted an approach that could address values, wildlife, differing worldviews, ecology, numbers, words. I wanted holism. I realize all this now. It is easy to know I wanted this as I write these words here. But subconsciously I must have known all of this then. I ended up in Saskatoon. I took Dr. Clark's funded project proposal and ran. I learned about process through the guise of scenario planning.

At the end of it all we ended with mounds of useful data that threatened to answer our posed questions and even some questions that we were unaware that we were asking. I thought we had been cool, using this approach in a somewhat novel manner with a foray into wildlife management. But the larger, cooler novelty

was about connecting ideas. The more time I spent with the data the more I began to feel as if this methodology had the potential to be used for more than taking a few wildlife managers through a strategic planning process.

With any luck and prudence, managing ecosystems (inclusive of human systems) will increasingly become a process centered (or de-centered?) on inclusiveness and holism. Further, decision-makers will increasingly need to act with imperfect information. Outcomes will be uncertain, because inputs will be tenuous at best. Due diligence will require decision-makers to use multiple knowledge systems in earnest and thoroughly engage multiple stakeholder groups. In this plausible future of wildlife management planning, a participatory scenario planning process can help.

A participatory scenario planning process can foster social learning, institutional linkages, and knowledge sharing: all elements that can improve the adaptive capacity of a governance system. It could also be used as a tool to proactively plan transformations of a SES. These areas warrant further exploration to understand how scenario planning can contribute to SES and resilience theory.

### **Adaptive Capacity through Learning**

When setting out to conduct the scenarios study, I wanted my work to build adaptive capacity. Adaptive capacity refers to “the capability of a SES to be robust to disturbance and to adapt to actual or anticipated changes” (Plummer and Armitage, 2010: 6). With respect to this definition, I wanted my participants to walk away from the study having learned something. More than that, they needed to be able to apply this new knowledge in a way that would improve the SES’s ability to adapt to

future changes. With any luck, actual outcomes from the study would provide these adaptive boosts.

I assumed the study would build capacity from the management goals we generated. Wildlife would thrive because my scenario team would have envisioned surprise events and put in place preemptory counteractive measures. These measures might look like developing new monitoring ideas or identifying sensitive wildlife habitat surrounding plausible future mining developments.

While this may happen, several participants mentioned that being exposed to the process in and of itself built adaptive capacity. Simply exposing them to a different way of thinking about the same management goals built adaptive capacity. This line of thinking supports scenario planning's ability to foster learning.

### **Facilitating adaptive learning**

Learning effectively from experience is an important aspect of adaptive management. In governing complex SESs, it is important for managers to learn in a way that develops his or her ability to deal flexibly with new situations. When this occurs in ecosystem management it is considered a social process known as "institutional" learning or "social" learning (Folke et al., 2005). More specifically, social learning is a process whereby a group assesses social-ecological conditions and responds in a way that supports its well-being (Kofinas, 2009: 91).

A process that generates knowledge and experience of ecosystem dynamics is said to improve the social capacity of responding to environmental change (Folke et al., 2005). This becomes true when the generated learning is expressed in

management practice (Folke et al., 2005). Keeping the above two points in mind, this study suggests that scenario planning is a process that fosters adaptive learning. In resource management, adaptive learning “provides the means for coping with uncertainty and change in a social-ecological environment” (Kofinas, 2009: 96). Kofinas (2009) claims that adaptive learning occurs when one or more groups:

1. Observe social-ecological conditions,
2. Draw on those observations to improve understanding of the system’s behavior,
3. Evaluate the implications of emergent conditions and options for action, and
4. Respond in ways that support the resilience of the SES (Kofinas, 2009: 96).

Engaged resource managers should be continually undertaking activity 1. Taking resource managers through the scenario planning process helped them to engage in activities 2, 3, and 4. Specifically, identifying drivers of change and axes of uncertainty parallels activity 2. Thinking about how drivers and axes interact to form future scenarios as well as examining threats and opportunities parallels the first part of activity 3 (Evaluate the implications of emergent conditions). Discussing possible management options parallels the second part of activity 3 (options for action). Lastly, developing management goals, monitoring needs, and identifying signposts that indicate the need for management action parallels activity 4.

The southwest Yukon SES has groups involved in processes that do facilitate adaptive learning. The renewable resource councils and established wildlife management teams are examples of bridging institutions. They meet and discuss social-ecological conditions as well as develop management recommendations.

Scenario planning, however, can provide a focus for those discussions with a holistic lens. It provides a methodical process to look at and evaluate the emergent conditions and possible trajectories of the changing SES.

### **Facilitating social and institutional learning**

Resource managers need to be flexible. To be flexible, managers need management approaches that are flexible (Hansen and Biringer, 2003). One way to improve flexibility of a management regime is by having mechanisms in place allowing managers to review the state of knowledge. Adaptive learning requires knowledge to be reviewed, evaluated, and sometimes modified when understanding improves (Kofinas, 2009). Scenarios are useful in this regard for their ability to help people reduce the complexity of complex systems (Peterson, 2007). Narrative-based scenarios provide an approach that is far more accessible to practitioners than alternative statistically and model-based scenarios. This allows participants to easily understand, discuss, and translate the scenarios between different contexts (Peterson, 2007). With high accessibility, people are more able to participate and consider meaningful management alternatives.

Findings from this study suggest that scenario planning can enhance the flexibility of an adaptive management regime by providing a forum for single-loop, double-loop, and triple-loop learning. Each of these learning mechanisms involves cyclical, experiential learning whereby practitioners reflect on the results of past actions. Single-loop learning refers to adjusting actions to meet identified management goals (Kofinas, 2009). An example of single-loop learning would be

changing harvest limits of moose to reflect new data about population size. The approach of harvesting moose is still the same, but with an adjusted harvest rate.

Participants in this study engaged in single-loop learning by recommending opening bison hunting to subsistence harvesting. Managers looked at population levels being high and suggested increasing the harvest by adding wood bison to the list of subsistence species for First Nations.

Double-loop learning is a process by which practitioners reflect on consequences of past actions before taking further actions (Kofinas, 2009). The feature that distinguishes the single-loop learning from double-loop learning is that double-loop learning calls into question basic assumptions and approaches. Under the guise of double-loop learning, actions are viewed as experiments that can be subsequently analyzed (Kofinas, 2009). An adjustment from double-loop learning might mean managers have rethought harvesting moose as an appropriate management tool.

An example of study participants engaging with double-loop learning is by reflecting under each scenario whether or not to prioritize management of culturally sensitive species. Participant managers looked at shifting management goals to ensure new species remain at socially acceptable levels. Scenario planning helped participants think about whether existing management approaches would be appropriate under different conditions.

Triple-loop learning, or transformative learning, involves a reevaluation of models and approaches as in double-loop learning. However, it adds a consideration of whether to alter norms, institutions, and paradigms in ways that might require a

change in governance (Folke et al., 2009). An example of triple-loop learning would be to shift from species-focused management to ecosystem-based management after reflecting on whether species-focused management has met its intended goals.

Participants in this study engaged with triple-loop learning by questioning the efficacy of the current planning processes available to them for planning wildlife management goals. Through reflecting, participants saw value in a holistic, long-term approach to developing management goals. This spurred them to recommend that longer-term planning processes, such as scenario planning, be conducted prior to developing management goals. Implementing a parallel planning process would cause a change in the wildlife management planning paradigm. Examining this briefly, it might force managers to rethink instituting a goal for one species that would operate at the expense of another species.

Developing management goals through the scenario planning process simultaneously takes managers through iterations of an adaptive learning cycle. Within a scenario planning process managers can devise plans to adjust actions, or develop entirely new approaches to meet goals based on new assumptions. With the right decision focus, a scenario team can even investigate a change in governance paradigms.

### **Enhancing institutional linkages**

Equity in power relationships in social-ecological governance contributes to social-ecological resilience (Armitage et al., 2007; Kofinas, 2009). Adaptive comanagement deals with solving problems associated with sharing management power across organizational levels (Carlsson and Berkes, 2005; Kofinas, 2009).

Power should be shared to promote diversity of opinion (Kofinas, 2009), participation (Folke et al., 2005; Kofinas, 2009) and trust (Plummer and Armitage, 2010).

Adaptive governance, therefore, should involve devolution of management rights. However, devolving management rights does not automatically result in adaptive co-management. Social networks are needed that allow for multidirectional information flows (Gadgil et al., 2003; Olsson et al., 2004; Folke et al., 2005; Olsson et al., 2006; Armitage et al., 2007; Kofinas, 2009). The success of these networks relies on the collaboration of a diverse set of stakeholders operating at a range of scales. Sharing of management power and responsibility may involve multiple institutional linkages between organizations (Folke et al., 2005).

Linking scales of governance is a challenge to building adaptive social-ecological governance. Despite the difficulty, institutional capacity will need to be strengthened to address variability and cope with the change and uncertainty of social-ecological systems (Berkes and Jolly, 2001; Chapin et al., 2009; Plummer and Armitage, 2010). Linkages, both horizontal and vertical, are important for their role in promoting knowledge sharing (Berkes and Jolly, 2001; Armitage et al., 2007; Kofinas, 2009). The findings of this study suggest that scenario planning provides mechanisms to build, or to strengthen, institutional linkages.

In this scenarios study, participants represented multiple governing organizations. During the workshops, participants interacted and discussed elements of the SES. This was an opportunity for the various organizations to share knowledge, which can provide additional sources of information. Multiple sources of



information can provide multi-scaled, interdisciplinary, and cross-cultural perspectives (Folke et al., 2005; Kofinas, 2009). This seems to be required for dealing with social-ecological dynamics during periods of rapid change and reorganization (Folke et al. 2005).

Knowledge shared during these workshops was not uniform. It came from varying perspectives, scales, and approaches. Some knowledge came from a First Nation perspective. Other knowledge came from the perspective of outfitters, individuals who worked for the Yukon Territorial Government, Parks Canada, Environment Canada, members of the Alsek Renewable Resource Council, or members of the Carmacks Renewable Resource Council. 88% of survey respondents agreed that scenario planning helped them understand points of view of other stakeholders (Table A.D.1.). All survey respondents agreed that scenario planning could help people with different perspectives collaborate and discuss issues (Table A.D.1.). By helping organizations to build trust and discuss shared mental models of plausible futures, scenario planning can further contribute to the success of adaptive co-management (Peterson, 2007). By having representatives present, the scenario planning process facilitated informational flows between all of these organizations.

The scenario planning process provides a forum where everyone in attendance can provide input and feedback (Appendix A, Steps 6-11, 16-20). This can empower groups that feel as if their perspectives are underrepresented under current governance models. Input from multiple, especially local knowledge systems, is important. Modern science is a well-organized system for expanding the world's knowledge. However, it lacks the wealth of detailed, context-specific

observations of the dynamics of complex ecological systems that can be found in some local knowledge (Gadgil et al., 2003). In fact, many local resource users of the world possess, as parts of their knowledge systems, site-specific knowledge of how to respond to disturbance and build adaptive capacity to changes (Berkes and Folke, 2002; Chapin et al., 2009). Thus, local knowledge systems offer important insights.

For the above reasons, environmental governance needs collaboration among diverse stakeholders (Plummer and Armitage, 2010). For this to occur there needs to be trust that input will be used, and used appropriately. In the Yukon, there are historic examples of traditional knowledge being stripped of its context and distilled into a western decision making paradigm (Nadasdy, 2003). It is important to note that precisely the opposite has also occurred in the Yukon. Summaries of First Nation (among others) involvement in conservation decisions during 55 Yukon projects between 1985 and 2003 can be found in a document compiled for the Government of Yukon by Barney Smith (Government of Yukon, 2004). Some examples show appropriate inclusion of TEK, while other examples show TEK unable to fit within the decision-making framework. This paper only attempts to communicate that the approaches used in this study can avoid the pitfalls of numeration by allowing other ways of knowing to be represented through scenario narratives.

### **Scenario planning for social-ecological system transformation**

Social-ecological systems will buffer disturbances to a point. However slight changes beyond a threshold and the system will reorganize itself (Kay, 2008). These reorganizations sometimes occur in ways beyond our ability to predict. Other times,

practitioners can attempt to manage the transformation of a SES. “Transformation” refers to the alteration of a system’s nature once the current conditions become untenable or undesirable (Walker et al., 2004). Navigating social-ecological system (SES) transformations is a recent theoretical development within the resilience literature (see Walker et al., 2004; Olsson et al., 2006; Chapin et al., 2009). Though, with the complexity of SESs there have been few methods contributed that can operationalize this theory for practitioners. I argue that scenario planning is a process that can help practitioners plan to navigate anticipated social-ecological transformations.

Several characteristics made the southwest Yukon an opportune context in which to undertake this study. First, the southwest Yukon is a SES in transition. Changing climate, introduced species, changing plant communities, and changing social and economic forces each test the resilience of the system. Additionally, the co-management context of the southwest Yukon is characterized by a high degree of institutional linkages through bridging organizations, consultation processes, and special interest groups. The presence of multiple First Nation communities, which actively participate in resource management, provides additional perspectives and sources of knowledge production. These linkages provide the region with improved adaptive capacity.

Transformations of SESs consist of two phases, a preparation phase and a transition phase. A window of opportunity then links the two phases (Olsson et al., 2006). Several steps in the scenario planning process seem to link to strategies for

navigating SES transformations. Chapin et al. (2009) list 6 strategies for preparing a SES for transformation:

1. Engage stakeholders to recognize dysfunctional states and raise awareness of the problem,
  2. Identify, recruit, and support potential change agents,
  3. Connect nodes of expertise and develop shadow networks of motivated actors,
  4. Identify plausible alternative states and pathways,
  5. Identify thresholds, potential crises, and windows of opportunity,
  6. Identify barriers to change and prepare strategies to overcome these
- (Chapin et al., 2009: 329).

Establishing a scenario team of local resource management experts connected nodes of expertise and motivated actors from differing cultural backgrounds and interests. Identifying drivers of change, grouping them into axes of uncertainty, and envisioning how they may interact into the future engaged participants to recognize thresholds and the dysfunctional state of the system. Identifying scenario logics and describing different plausible futures served to identify alternative states into which the system could transform. Identifying threats and opportunities present in each scenario, management goals, recommendations to accomplish the goals, monitoring needs, and resource gaps served to identify potential crises and develop strategies to overcome barriers to change. Through the development of indicators, scenario planning can enhance the flexibility of a governance framework to seize windows of opportunity for SES transformation.

In our workshops, participants envisioned scenarios where culturally important wildlife populations struggled. This helped them to understand the potential for new ungulate species to provide a more food secure future. This led participants to develop a management goal to maintain new ungulate populations at socially desirable levels. Implementing the goals from the workshops could see the southwest Yukon SES directed to a new system state, one with radically altered biological communities.

The scenario planning process helped our participants identify system states and potential pathways for changes. By exploring different policy options scenario planning can help reduce the likelihood of shifts to undesirable system states, or conversely, improve the likelihood of shifts to desirable system states.

With the level of discussions relating to food security, a desired system state seems to be one that represents a food secure future. More specifically, this means a system state with animals on the landscape in sufficient numbers to support a harvest. Instituting management goals that allow the new ungulate species to persist on the landscape (I.E. Goal cluster F, Table 3.3) could help direct the SES towards a desired, food secure scenario. For example, improving critical habitat areas for these new species (management recommendation from goal cluster F, scenario 2, Appendix E, Table A.E.1, Table A.E.2, Table A.E.3) could help to transform some of the biological components of the SES. Developing signposts, which are briefly discussed below, will help wildlife managers understand when changes to the SES are happening and when to institute certain management interventions.

It is important to remember that our scenario team was comprised of individuals who have an interest in conserving natural resources, including wildlife. A desirable scenario to these participants would be representative of management interests, but might be different from the average southwest Yukoner.

By helping resource managers engage in double-loop and triple-loop learning, scenario planning can enhance a management regime's ability to quickly enact new management policies. These policies, such as new ways to manage the harvest or a new institutional arrangement of local bridging organizations could help shift the system towards desirable outcomes. This will be increasingly important in a world of rapid change and complex problems.

### **Towards an inclusive approach**

There were many ideas discussed in the workshops that ultimately revolved around adjusting, or even transforming, wildlife management. Some participants felt as if the conventional planning approaches are failing to meet today's needs. Resource management needs to regularize alternative governance models that include alternative methods and avenues for decision-making. Resilience will partially depend on human capacity to adjust governance to implement new solutions (Chapin et al., 2010).

Researchers and practitioners need to be comfortable transcending disciplines. This especially means transcending the boundaries of what approaches and information can be used. Science is necessary, but insufficient on its own to solve today's complex problems (Gibeau, 2012). The scientific community needs to

find ways to integrate other sources of information and to ease its integration. This is because science only provides some of the puzzle's pieces.

Let us take scenario planning as an example. It has many approaches. Some argue that a qualitative approach is unscientific because it is not reproducible, whereas a quantitative approach is reproducible and therefore scientific (Alcamo, 2008). While this is true its relevance is relative. More important than a method's degree of being scientific is its helpfulness for a given situation.

As mentioned in the introductory chapter, quantitative scenarios based on mathematical models are good for simulating well-understood systems over sufficiently short times. But predictive ability decreases with increasing complexity of the system and lengthening time horizon (Swart et al., 2004). In other words, exclusively quantitative scenarios make poor simulations of complex social-ecological systems (Swart et al., 2004), such as the SES in this study.

In our scenario study, we wanted an approach that could insert qualitative data that may or may not be value-laden. A quantitative modeling approach would have been prohibitively inflexible for our inputs. Preferring “hard,” quantified facts over “soft” data can at times accentuate a bias towards single-point futures (Ralston and Wilson, 2006: 202)—exactly what we wanted to avoid. This scenario planning example shows that numbers cannot always pave a road to an answer. Therefore, novel approaches to solving problems that are capable of using multiple sources of knowledge will become increasingly important.

One line of reasoning behind arguments that conventional wildlife management planning is failing in the Yukon is due to its heavy reliance on

quantifying the biological elements of the ecosystem. Several participants described its bias towards numbers as being focused on “science of the parts.” This reductive approach ignores integrated approaches to knowledge production (Kofinas, 2009). Instead, the goal should be to improve understanding of the dynamics of the whole system (Folke et al., 2005).

Today’s complex problems demand that resource managers move away from a purely positivistic science approach. Instead, we need approaches that draw from multiple knowledge systems, worldviews, and levels of stakeholder engagement (Plummer and Armitage, 2010; Gibeau, 2012). To be more effective, wildlife management needs to move beyond simply the biological elements and involve people in a meaningful way. It needs to institute participatory forms of engagement that move beyond typical forms of “consultation” such as media releases, brochures, and open meetings (Armitage et al., 2007; Gibeau, 2012). Scenario planning provides a process in which people can be meaningfully involved. It sets people on equal footing to have collaborative discussion. Though, it is important to mention that plans coming out of the process are non-binding and don’t necessarily result in decisions. But it is a process that allows for sharing of power, and a way to rebuild trust and relationships.

In many resource management contexts, there is distrust between resource managers and stakeholders born from years of animosity and philosophical differences. Therefore, to engage people effectively resource managers need a process that restores trust and rebuilds relationships (Berkes et al., 2003; Gibeau, 2012). An inherent value of the format of the scenario planning process is in its



ability to get people to discuss issues in a more hypothetical context through a series of workshops. During the process, people can unpack long-term disagreements, reconcile long-term goals, and perhaps most importantly reach an understanding of other's perspectives. Group cohesion can tighten when people understand each other's perspectives (Gibeau, 2012). This is not asking that everyone agree with one another. That is unrealistic and, in the long term, detrimental. This instead asks that we utilize planning processes that contribute to people respecting each other.

### **Signposts/Indicators**

Time ran out in workshop 3 before the scenario team could discuss indicators. Indicators, known in the scenario planning literature as signposts, are benchmarks that are periodically reviewed to track change and make management adjustments to stay on track to meet goals (Kofinas, 2009). They are a "specific value or outcome of an important force of driver" (Ralston and Wilson, 2006: 168). It is important that signposts focus on two things. First, they should focus on forces upon which managers can act. Second, they focus on forces that can give an early warning sign (Ralston and Wilson, 2006: 168).

I will use some space here to give a few examples of what might be useful signposts. Keeping the two features in mind, we can focus on the important force of mining production. S1 and S2 feature heavy mining activity, with the Killermun Mine going online in the Ruby Range. An indicator could be if YESAB grants permits to construct a new mine in the area. It might indicate that wildlife managers should

focus resources on protecting key habitat that may be affected by the mining development. This development might more generally signal that the system is heading towards a future of higher environmental exploitation and cumulative effects.

Another important force for the SES is parasites and diseases. S3 featured both invasive bark beetle outbreaks and disease in the wood bison herd. An example of a signpost might be small groups of dying lodgepole pine. This might indicate that mountain pine beetle has moved north and that an outbreak is looming. This development might more generally signal that the system is heading towards a future of more abrupt, rapid environmental changes.

To give a final example, let us focus on attitudes and values. S1 featured miners speed boating on Pine Lake, which disrupted elders' ability to cast fish nets. An indicator might be a certain frequency of complaints from First Nation elders about disruptions to a traditional lifestyle. This might indicate both a change in territory demographics and/or a shift in values. This development might more generally signal that the system is heading towards a future of an exploitative ethic.

Signposts are helpful tools to alert managers of impending changes. Once alerted, managers can intervene with pre-developed management actions. Though I have provided only three example indicators out of hundreds of possibilities, I hope it gives readers an idea of the possible.

## **Communication**

Communicating the results of the study is a priority since a goal of the study is to improve adaptive capacity of the management framework. Copies of resulting

management goals will be sent to workshop and interview participants, affected renewable resource councils, affected First Nations, The Yukon Wood Bison Technical Team, The Yukon Elk Management Planning Team, and to the Yukon Fish and Wildlife Management Board. For non-academic audiences, information will be available for key audiences (e.g. hunters and trappers) using appropriate media (e.g. handouts at community events). A poster of the scenario illustrations was given to the ARRC, CAFN, and Environment Yukon. Appropriately communicating results will help maintain relationships with local communities and management institutions for future collaborative research opportunities, especially to assess local climate change impacts.

### **Future research**

There is a need to increase our understanding of interactions between elements of the SES. Perhaps the biggest, most asked question is how do the new species impact caribou, moose, sheep, or salmon; species of both cultural and economic importance to the area? Other questions warranting further research are, what is the extent of predation on the new species? What impact might predation on the new species have on the SES into the future? Lastly, what are new disease risks and what are ways to minimize outbreaks? These questions are just a few unknowns unearthed during the scenario planning process that could help wildlife managers make more educated decisions.

New research needs provide opportunities for increased partnerships and knowledge sharing between management groups, such as First Nation Governments and Yukon Territorial Government departments. It also provides avenues for

university partnerships and to help train the next generation of biologists and resource managers.

### **Concluding Remarks**

This study started off with the very practical intentions of providing a novel way for southwest Yukon wildlife managers to develop wildlife management goals. We wanted to try-out the scenario planning process and gauge response. While these goals were accomplished, the conversation transformed into one that was much more theoretical in nature. It became about thinking differently. It became about values—how they may differ contextually and how they may shift. It became about seeing the silver lining of anticipated system threats. It became a discussion about seeing those threats as opportunities to build resilience and adaptive capacity. In summary, I found that scenario planning offers more than I expected.

The thoughts presented here in this concluding chapter are in their infancy and are beyond the scope of this thesis to investigate further. However, they reconnect scenario planning, a major focus of this study, to SES theory. Scenario planning provides opportunities to operationalize and connect together many tenets of social-ecological systems, adaptive governance, and resilience.

This thesis demonstrates how, through scenario planning, resource managers can engage in collaborative discussion with people of differing perspectives. They can open their minds to broader thinking, envisioning how identified driving forces might interact into the future. They can see different ways that the SES could change. They can implement plans to direct the SES to a desired scenario. They can plan ways to adapt to, or build resilience to the changes. Scenario

planning, therefore, is a powerful planning tool that can improve practitioners' adaptive capacity in the face of uncertain changing conditions.

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## **APPENDICES**

### **Appendix A. Steps of Scenario Development Process**

#### **Step 1 – Develop Case for Scenarios**

A socioeconomic impact assessment uncovered impacts on members of the Champagne-Aishihik First Nations (CAFN) resulting from the wood bison reintroduction (Clark, 2011 unpublished data). There was discussion between CAFN, the Alsek Renewable Resource Council, and Dr. Clark about researching different ways to manage the Aishihik Wood Bison Herd. It was agreed that a scenarios approach could be an effective method to try.

#### **Step 2 – Gain Support**

Dr. Clark applied for and received funding from the Social Sciences and Humanities Research Council of Canada. In our adapted scenario planning process we did not have to gain the support from an executive board of a company. We did, however, need to convince a funding body as well as local and regional wildlife managers that this was a worthwhile exercise.

#### **\*Step 3 – Gain Ethics Approval**

The project obtained Certificate of Approval from the Behavioural Research Ethics Board of the University of Saskatchewan (Beh #10-191) and one Yukon Scientist and Explorer's License for each year that research was conducted in the Yukon (11-15S&E, 12-03S&E, 13-16S&E). Ralston and Wilson (2006) do not mention obtaining ethics approval because workshops conducted in a corporate environment do not need ethics approval.

#### **Step 4 – Form Scenario Team**

Researchers invited members of the Yukon Wood Bison Technical Team and Yukon Elk Management Planning Team to be members of the scenario team. Representatives of these teams were seen to have expert and local knowledge the southwest Yukon SES in which wood bison, elk, and mule deer inhabit.

#### **Step 5 – Discuss Process**

In the first workshop, researchers discussed theory behind scenario planning, gave a few examples of other uses of the method, and described how it might be useful in a wildlife management context in the southwest Yukon. Participants agreed to continue with the scenario planning exercise.

#### **\*Step 6 – Define Focus and Objectives**

After formalizing the research process, researchers and participants agreed on a decision focus for the project that would help decision makers use the results from the scenarios. The decision focus was how should the new ungulate species be managed in the future?

In a participatory research context, this step also amounts to defining and agreeing upon the objectives of the research. The scenario team discussed the



objectives needed to achieve the decision focus and added a secondary objective to examine whether participants felt scenario planning was useful as a tool to develop wildlife management goals.

#### Step 7 – Identify Forces/Drivers

The scenario team brainstormed as a group to identify as many forces that are driving change in the southwest Yukon SES. 46 drivers were identified (Appendix B).

#### Step 8 – Assess Impacts and Uncertainties

Participants were asked to rank the drivers in terms of high-low impact and high-low uncertainty using a Q-Sort. The goal of the step was to help participants focus on drivers that seem most likely influence the future direction of the SES. This step had another objective of trying to understand managers' perspectives about how change influences their decision making (Beach and Clark, unpublished data).

#### Step 9 – Identify Axes of Uncertainty and Axis Logics

Trying to think about each driver interacting into the future would be difficult. Exploring a large set of drivers that have been grouped into a theme, or axis, is a more manageable task. Axes of uncertainty are essentially the previously identified drivers grouped into a set of 2-3 themes. Examining how these themes will interact is what the scenario team uses to create the future scenarios. The themes in this study amounted to the main forces affecting the southwest Yukon SES. The individual drivers resurface in the process as details to describe the future. Once axes were selected, participants identified the logics for the axes, or the two polar directions an axis could manifest in the future. See Appendix B for axes of change and the associated logics.

#### Step 10 – Select Scenario Logics

Grouping the various axis logics together yields possible scenario logics (Appendix C). Scenario narratives are written only for scenarios that the scenario team deems plausible, and the set of which, will cover enough of the envelope of uncertainty to stimulate a useful conversation about potential management actions.

#### Step 11 – Describe Scenarios

For each scenario the scenario team was asked to provide details to help flesh out how the future scenario might look and feel. They were instructed to think about how individual drivers might interact in the future, thinking about causal relationships and considering the direction and interactions of the axes of uncertainty. Researchers captured these details on flip charts and in personal notebooks.

#### \*Step 12 – Verify Participant Input

Ralston and Wilson (2006) have “Gather Data” as their 7<sup>th</sup> step (Ralston and Wilson, 2006: 61). In their process, they recommend gathering pre-data prior to the first workshop. Often this is quantitative in nature and gives the scenario team

numbers to work with, or even an initial “business as usual” scenario that projects current trends, during the first workshop. In this scenario process, researchers came to the first workshop without any prior data. This process was intended to be fully participatory, with all of the descriptions of the future coming from the scenario team itself. Since this was an experiment, this also served as a way to remove bias of the researchers.

The researchers did gather data on the system, but as a way to crosscheck and expand upon participant input. Outside of the workshop, details provided by the scenario team were verified using gray and primary literature. It is important that scenarios are consistent with current ecological understanding (Carpenter, 2002) and that the events portrayed within the scenarios are possible. Implausible scenarios result in weak decision making potential (Ralston and Wilson, 2006: 121). An example of verifying participant input was when a participant mentioned a Killermun mining project being a potential mining operation in the future. This comment was verified by the existence of a Yukon Environment and Socio-Economic Assessment Board (YESAB) file indicating that YESAB conducted an assessment of a mining exploration project in the Ruby Range 46 km northwest of Haines Junction. Further research into the YESAB files revealed potential disturbances from the project as well as economic benefits. These details ultimately became major components of two of the scenarios and helped to visualize plausible, high cumulative land use in the future.

#### Step 13 – Write Scenarios

It would be nearly impossible to write the scenario narratives in a workshop setting with the entire scenario team present. It would take time and would lack coherence and flow (Ralston and Wilson, 2006: 130). For this reason a single individual (Dylan Beach) wrote the scenarios outside of the workshops using input from the scenario team. The scenario narratives took on the form of a newspaper article, a format that was thought to be widely digestible by wildlife managers and the general public. The scenario narratives traced major trends and developments of main forces. They contain descriptions of cause and effect chains before and after major events. See Appendix F for the full scenario narratives.

#### \*Step 14 – Create Visuals for Scenarios.

Researchers worked with a local Yukon artist to represent main themes and important drivers that came from the workshops in a set of four computer-generated images, one image for each scenario (Figure 3.1). This is not given a specific step in the handbook but is recommended as a way to communicate results (Ralston and Wilson, 2006: 202). Visuals are important for their ability to help people imagine future scenarios.

#### \*Step 15 – Comments on Scenario Drafts

While Ralston and Wilson (2006) do not give commentary a specific step in the handbook, it is essential to keeping the research process participatory and so is being emphasized here. Drafts of the scenario narratives were circulated to the scenario team for comment. The researchers conference called into a YWBTT

meeting to hear comments. Comments were also accepted by email. Received comments were incorporated into the final drafts. For example, an individual mentioned that there did not seem to be many surprises or wildcards in the scenarios. After this comment, disease featured prominently in scenario 3. Ralston and Wilson (2006) recommend circulating drafts and starting the third workshop with comments and potential amendments (Ralston and Wilson, 2006: 130). This was viewed as time consuming and so received comments were incorporated into the final drafts by the writer prior to the third workshop.

#### Step 16 – Rehearse the Future

This step has four major parts: immersion, identifying opportunities and threats, identifying goals, and identifying monitoring needs. Ultimately, this step is about understanding the strategic implications of each scenario for wildlife management. After this step the scenario team should reach conclusions about what are the most important threats and opportunities and what strategy they would implement to realize the most value in that scenario (Ralston and Wilson, 2006: 144).

##### Immersion

Immersion is a step that the scenario team undertakes for each scenario prior to identifying opportunities, threats, goals, and monitoring needs. It is designed to help scenario team members to re-acquaint themselves with the dynamics of the scenario. Immersing participants in the scenario forces them to confront the extreme yet plausible conditions in each scenario.

In order to save time, the researchers broke down the scenario team into two groups. One group looked at scenarios 1 and 3 while the second group looked at scenarios 2 and 4. Researchers read a short summary of each scenario that recapped some of the major events and trends of the scenario.

##### Identify Opportunities and Threats

Participants were asked what opportunities and threats they would face if they knew a particular scenario were going to occur.

##### Identify Goals

Once the scenario team identified opportunities and threats, they could think about different management goals to take advantage of the opportunities and remove threats.

##### Identify Monitoring Needs

The scenario team looked at what monitoring programs already existed or would need to be implemented for the management goals.

#### Step 17 – Select Goals

Many of the goals that participants identified either overlapped for the same scenario, or overlapped across scenarios. For this reason, goals were grouped based

on similarity and these became the 7 goal clusters identified through the scenario exercise (Figure 3.3).

#### Step 20 – Identify Signposts

Identifying future goals and understanding their risks and rewards is great, but managers need to know when to implement them. Signposts are indicators that alert managers that a particular scenario and dynamics are going to occur (Ralston and Wilson, 2006: 142). There was not enough time to discuss specific signposts at the final workshop, so the researchers developed recommendations for signposts outside of the workshop.

#### Step 21 – Communicate Results

Without communication, the scenario exercise will help no one prepare for uncertain futures. Scenarios will be shared with the general public via handouts and community events. More in-depth implications of the scenarios, including management goals and lessons will be shared with workshop participants and groups with management stakes.

\*Denotes steps that were new and/or altered from Ralston and Wilson (2006).

## Appendix B. Driver and Axis Table.

**Table A.B.1.** Drivers of change, axes, and axis logics. Drivers of change listed alphabetically and grouped by axis of uncertainty.

<p>Unpredictable Change</p> <p>↑</p> <p><b>Changing Ecological-Social Interactions</b></p> <p>↓</p> <p>Gradual Change</p>	<p>High Cumulative Impacts</p> <p>↑</p> <p><b>Land Use</b></p> <p>↓</p> <p>Low Cumulative Impacts</p>	<p>Exploitative</p> <p>↑</p> <p><b>The Human Factor</b></p> <p>↓</p> <p>Stewardship</p>
<p>Changing Water</p> <p>Climate Change</p> <p>Country Food</p> <p>Culturally Sensitive Species</p> <p>Food Security</p> <p>Hunter Patterns</p> <p>Hunting Values</p> <p>Insects</p> <p>Invasive Species</p> <p>Loss of Caribou</p> <p>Meadows</p> <p>Moose</p> <p>Parasites and Diseases</p> <p>Predation - Bear, Wolf, Cougar, &amp; others</p> <p>Repetitive Fire</p> <p>Shakat - Lifestlye Calendar</p> <p>Species Shifts</p> <p>Treeline</p>	<p>Access</p> <p>Agriculture</p> <p>Business Opportunity</p> <p>Electricity Projects</p> <p>Exploration</p> <p>Forestry</p> <p>Free Land</p> <p>Global Economy</p> <p>Human Development on Landscape</p> <p>Infrastructure</p> <p>Land Use Planning</p> <p>Local Development</p> <p>Markets</p> <p>Mining</p> <p>Natural Resource Demand - Gold, Copper</p> <p>Production</p> <p>Protected Areas</p> <p>Sprawl</p> <p>Technology</p> <p>Traffic Patterns/Density</p>	<p>Affluence</p> <p>Attitudes and Values</p> <p>Laws</p> <p>Lifestyle</p> <p>Open Regulatory Regime</p> <p>Regulations</p> <p>Teaching</p> <p>Yukon Territory Demographics</p>

## Appendix C. Scenario logics table.

**Table A.C.1.** Possible scenario logics. The 4 black combinations were deemed plausible and are shown with the final scenario names. The 4 red combinations were deemed not plausible and were discarded.

	High Cumulative Impacts	Unpredictable Change	Stewardship
<b>Doom and Gloom (S1)</b>	High Cumulative Impacts	Unpredictable Change	Exploitative
	High Cumulative Impacts	Gradual Change	Stewardship
<b>Slow Boil (S2)</b>	High Cumulative Impacts	Gradual Change	Exploitative
<b>A Confused State (S3)</b>	Low Cumulative Impacts	Unpredictable Change	Stewardship
	Low Cumulative Impacts	Unpredictable Change	Exploitative
<b>Win-Win (S4)</b>	Low Cumulative Impacts	Gradual Change	Stewardship
	Low Cumulative Impacts	Gradual Change	Exploitative

## Appendix D. Survey questions and results table.

### Perceptions of Scenarios - Workshop Two Survey

1. Did you find it difficult to identify drivers of change?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

2.What helped you to identify drivers of change?

Comments:

3. In future scenario planning workshops, what would aid in identifying drivers of change?

Comments:

4. Did you find it difficult to visualize future scenarios?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

5. What helped you visualize future scenarios?

Comments:

6. In future scenario planning workshops, what would aid in visualizing future scenarios?

Comments:



7. Did the scenario planning process help you understand points of view of other stakeholders?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

### Perceptions of Scenarios - Workshop Three Survey

1. Did something specific to the scenario planning process help you develop management goals for different future scenarios?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

2. Did you find it difficult to develop management goals for different future scenarios? If so, was anything missing that would help in future workshops?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

3. Did scenario planning help you think about how forces might interact in the future?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

4. Did scenario planning help you think about uncertainty in the future?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

5. Did scenario planning change the way you think about wildlife management issues?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

6. Did you learn something during the scenario planning process that will be of value to you for managing wildlife in the sw Yukon?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

7. Could you see yourself using the scenario planning process in the future?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

8. Could you see yourself using the outcomes from this particular scenario planning process?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

9. Is scenario planning a method that could help people with different perspectives collaborate and discuss issues?

Strongly Disagree

☐

Disagree

☐

Neutral

☐

Agree

☐

Strongly Agree

☐

Comments:

**Table A.D.1.** Survey results. Shown as the number and percentage of respondents that responded by agreeing, disagreeing, or feeling neutral to the survey questions.

<b>Response</b>	<b># Respondents</b>	<b>% of Respondents</b>
<b>Did you find it difficult to identify drivers of change?</b>		
Agree/Strongly agree	3	38%
Neutral	0	0%
Disagree/Strongly disagree	5	62%
<b>Did you find it difficult to visualize future scenarios?</b>		
Agree/Strongly agree	2	25%
Neutral	2	25%
Disagree/Strongly disagree	4	50%
<b>Did something specific to the scenario planning process help you develop management goals for different future scenarios?</b>		
Agree/Strongly agree	5	83%
Neutral	1	17%
Disagree/Strongly disagree	0	0%
<b>Did scenario planning help you think about how forces might interact in the future?</b>		
Agree/Strongly agree	5	83%
Neutral	1	17%
Disagree/Strongly disagree	0	0%
<b>Did scenario planning help you think about uncertainty in the future?</b>		
Agree/Strongly agree	5	83%
Neutral	1	17%
Disagree/Strongly disagree	0	0%
<b>Did you learn something during the scenario planning process that will be of value to you for managing wildlife in the southwest Yukon?</b>		
Agree/Strongly agree	6	100%
Neutral	0	0%
Disagree/Strongly disagree	0	0%
<b>Could you see yourself using the scenario planning process in the future?</b>		
Agree/Strongly agree	6	100%
Neutral	0	0%
Disagree/Strongly disagree	0	0%
<b>Could you see yourself using the outcomes from this particular scenario</b>		

**planning process?**

Agree/Strongly agree	6	100%
Neutral	0	0%
Disagree/Strongly disagree	0	0%

**Is scenario planning a method that could help people with different perspectives collaborate and discuss issues?**

Agree/Strongly agree	6	100%
Neutral	0	0%
Disagree/Strongly disagree	0	0%

**Did the scenario planning process help you understand points of view of other stakeholders?**

Agree/Strongly agree	7	88%
Neutral	1	12%
Disagree/Strongly disagree	0	0%

## Appendix E. Management goal summary tables.

Summary tables showing all management goals, management recommendations, monitoring needs, and resource gaps developed by the scenario team during workshop three. Tables are species-specific. Table A.E.1 discusses wood bison. Table A.E.2 discusses elk. Table A.E.3 discusses mule deer. Management outcomes were arranged by species to facilitate ease of use by the existing management framework.

**Table A.E.1.** Summary table for wood bison. The table lists all management goals, management recommendations, monitoring needs, and resource gaps described by the scenario team. They are organized by scenario. Capital letters at the beginning of each bullet point refer to the management goal cluster (Table 3.3) to which the particular bullet point relates.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Management Goals	<ul style="list-style-type: none"> <li>▪ D – Maintain viable populations in the Yukon while reducing impact on caribou, moose, and sheep.</li> <li>▪ F – Increase harvest.</li> <li>▪ F – Increase moose and caribou populations while maintaining a bison population.</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Contain population. Encourage hunting and less environmental impacts to the Yukon.</li> <li>▪ C – Determine impacts/changes from mining impacts.</li> <li>▪ C – Determine landscape changes.</li> <li>▪ C – Determine social impacts associated with a changing landscape.</li> <li>▪ G – Manage to promote ecological restoration and encourage sustainable harvest.</li> <li>▪ G – Understand and minimize their impacts to people, other wildlife, and the land.</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Maintain free-ranging, viable, disease-free population at levels that conserve culturally sensitive species.</li> <li>▪ A – Limit bison in key moose and caribou habitat if habitat is a limiting factor.</li> <li>▪ D – Maintain a sustainable population.</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Keep populations at a socially acceptable size, while allowing for ecological restoration and harvest.</li> <li>▪ F – Implement an enumeration plan to better manage the population as well as decrease its environmental impacts.</li> <li>▪ F – Manage for a sustainable harvest.</li> <li>▪ F – Maintain and protect native wildlife populations and their habitats.</li> </ul>
	<ul style="list-style-type: none"> <li>▪ D – Increase population numbers</li> <li>▪ D – Increase harvest</li> <li>▪ D – Work with First Nations to</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Manage population numbers</li> <li>▪ A – Encourage hunting</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Mandatory submission of hunter samples</li> </ul>	<ul style="list-style-type: none"> <li>▪ D – Prevent transmission of diseases to other</li> </ul>

<p>Management Recommendations</p>	<p>reduce conflicts</p> <ul style="list-style-type: none"> <li>▪ D – Encourage First Nation harvest</li> <li>▪ D – Sell local bison in local stores</li> <li>▪ D – Enact management recommendations suggested by research to reduce competition with moose, caribou, and sheep</li> <li>▪ D – Prohibit commercial bison farming</li> <li>▪ F – Increase hunting pressure in buffer areas to reduce expansion into caribou and moose habitat</li> <li>▪ F – Open to subsistence harvesting</li> </ul>	<p>access</p> <ul style="list-style-type: none"> <li>▪ A – Create baseline data</li> <li>▪ A – Build capacity</li> <li>▪ C – Determine what activities and the level of activity that causes various responses</li> <li>▪ C – Determine environmental changes</li> <li>▪ C – Determine landscape responses</li> <li>▪ F – Conduct predation control program</li> <li>▪ F – Manage harvest</li> <li>▪ F – Identify and manage critical habitats</li> <li>▪ G – Discourage bison from using critical caribou and moose habitat</li> <li>▪ G – Manage harvest to maximize success rates and minimize impacts from bison on people, other wildlife, and the land</li> <li>▪ G – Increase public appreciation</li> <li>▪ G – Help communities adapt to bison being on the land and being important as a harvested species</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Regulate movement of bison through the Yukon</li> <li>▪ A – Locate bison farming away from free-ranging herds and disease testing</li> <li>▪ A – Destroy diseased animals</li> <li>▪ A – Increase education to encourage appreciation</li> <li>▪ A – Protect key moose and caribou habitat from bison by hunting</li> <li>▪ G – Hunter education to increase appreciation</li> </ul>	<p>wildlife</p> <ul style="list-style-type: none"> <li>▪ F – Minimize habitat-based competition between native species and bison</li> <li>▪ F – Identify overlapping habitats</li> <li>▪ F – Identify behavioral change</li> </ul>
	<ul style="list-style-type: none"> <li>▪ D – Bison population and distribution in conjunction with overlapping caribou, moose, and</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Responses to mining development</li> <li>▪ C – Drivers of change</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Bison expansion and distribution</li> <li>▪ A – Disease</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Harvest levels and patterns of harvest</li> <li>▪ F – Competition</li> </ul>



Monitoring Needs	<p>sheep populations.</p> <ul style="list-style-type: none"> <li>▪ F – Habitat use</li> <li>▪ F – Interactions with humans and other species</li> </ul>	<p>and the effects and outcomes</p> <ul style="list-style-type: none"> <li>▪ C – Bison responses to environmental and landscape changes</li> <li>▪ F – Habitat use</li> <li>▪ F – Population recruitment level</li> <li>▪ F – Harvest levels and patterns of harvest</li> <li>▪ G – Harvest interest, permit and harvest numbers, success rates</li> <li>▪ G – Population size, trends, distribution</li> <li>▪ G – Impacts of landscape change on bison</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Habitat needs</li> <li>▪ D – Disease</li> </ul>	<p>between native species and bison</p> <ul style="list-style-type: none"> <li>▪ F – Impacts</li> <li>▪ F – Population growth and trends</li> <li>▪ F – Disease</li> <li>▪ F – Invasive species</li> </ul>
Resource Gaps	<ul style="list-style-type: none"> <li>▪ D – Research about competition between bison and native species</li> <li>▪ D – Locally available meat and products in stores</li> <li>▪ F – Regulations allowing for subsistence harvest</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – First Nation capacity</li> <li>▪ C – Research capability</li> <li>▪ C, F – Partnership with First Nations</li> <li>▪ C – Long term program and partners</li> <li>▪ F – Maintained work plan for programs and resources</li> <li>▪ G – Political will to increase the profile</li> <li>▪ G – Knowledge of future impacts that bison may have on people, wildlife, and the land</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Money for disease monitoring</li> <li>▪ A – Disease monitoring protocols</li> <li>▪ A – Veterinarians on government staff</li> <li>▪ D – Education on food availability</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Better understanding of impacts</li> <li>▪ F – Model population dynamics under different management scenarios</li> </ul>

**Table A.E.2.** Summary table for elk. The table lists all management goals, management recommendations, monitoring needs, and resource gaps described by the scenario team. They are organized by scenario. Capital letters at the beginning of each bullet point refer to the management goal cluster (Table 3.3) to which the particular bullet point relates.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Management Goals	<ul style="list-style-type: none"> <li>▪ F – Maintain introduced populations at low levels in restricted areas to provide for hunting and food opportunities and increased wildlife diversity</li> <li>▪ F – Maintain current population and keep within current range</li> <li>▪ F – Increase moose and caribou population while maintaining an elk population</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Co-management with all levels of governments.</li> <li>▪ C – Determine impacts/changes from mining impacts.</li> <li>▪ C – Determine landscape changes.</li> <li>▪ C – Determine social impacts associated with a changing landscape.</li> <li>▪ F – Manage for a sustainable harvest.</li> <li>▪ F – Provide for a self-sustaining population at socially acceptable level.</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Limit elk in key moose and caribou habitat if habitat is a limiting factor</li> <li>▪ D – Maintain a sustainable bison population</li> <li>▪ G – Conserve introduced herd for hunting opportunities (food security) and encourage biological diversity</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Implement an enumeration plan to better manage the population as well as decrease its environmental impacts</li> <li>▪ F – Keep population at a socially acceptable level</li> <li>▪ F – Manage for a sustainable harvest</li> <li>▪ F – Maintain and protect native wildlife populations and their habitats</li> </ul>
Management	<ul style="list-style-type: none"> <li>▪ D – Encourage First Nation harvest</li> <li>▪ D – Prevent transmission of diseases to other wildlife</li> <li>▪ F – Increase hunting opportunities for residents and First Nations</li> <li>▪ F – Increase hunting pressure in buffer areas to reduce expansion into caribou and moose habitat</li> <li>▪ F – Control location of agriculture through agricultural land applications</li> <li>▪ F – Maintain current habitat area</li> <li>▪ F – Continue current</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Determine what activities and the level of activity that causes various responses</li> <li>▪ C – Determine environmental changes</li> <li>▪ C – Determine landscape responses</li> <li>▪ C – Decrease highway collisions</li> <li>▪ C – Manage predation i.e. wolves</li> <li>▪ C – Disease control</li> <li>▪ C – Decrease or eliminate invasive</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Protect key moose and caribou habitat from elk by hunting</li> <li>▪ G – Liberalize hunting in buffer areas near caribou or moose ranges</li> <li>▪ G – Monitor and manage disease</li> <li>▪ G – Continue limited entry hunt</li> <li>▪ G – Hunter education to increase appreciation</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Minimize habitat-based competition between native species and elk</li> <li>▪ F – Keep harvest low</li> <li>▪ F – Keep population low</li> <li>▪ F – Manage impacts</li> <li>▪ F – Identify overlapping habitats</li> <li>▪ F – Identify behavioral change</li> </ul>

Recommendations	<p>management</p> <ul style="list-style-type: none"> <li>▪ F – Locate commercial elk ranches away from wild herds to reduce human-wildlife conflict and disease transmission</li> </ul>	<p>species</p> <ul style="list-style-type: none"> <li>▪ F – Conduct predation control program</li> <li>▪ F – Manage harvest</li> <li>▪ F – Identify and manage critical habitats</li> <li>▪ F – Maintain population size that is socially acceptable but will allow for a modest harvest</li> <li>▪ F – Manage social concerns i.e. road crossings</li> <li>▪ F – Manage potential impacts of elk on other species on the land</li> <li>▪ F – Keep population size low</li> </ul>		
Monitoring Needs	<ul style="list-style-type: none"> <li>▪ F – Tick in elk and moose populations</li> <li>▪ F – Population, trends, and distribution particularly in relation to roads and communities</li> <li>▪ F – Disease</li> <li>▪ F – Access to highway corridors</li> <li>▪ F – Habitat use</li> <li>▪ F – Interactions with humans and other species</li> <li>▪ F – Species adaptation</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Responses to mining development</li> <li>▪ C – Drivers of change and the effects and outcomes</li> <li>▪ C – Elk responses to environmental and landscape changes</li> <li>▪ F – Population, trends, and distribution particularly in relation to roads and communities</li> <li>▪ F – Habitat use</li> <li>▪ F – Determine population recruitment level</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Habitat needs</li> <li>▪ D – Disease</li> <li>▪ G – Disease and ticks</li> <li>▪ G – Population and distribution</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Harvest levels and patterns of harvest</li> <li>▪ F – Competition between native species and elk</li> <li>▪ F – Disease</li> <li>▪ F – Invasive species</li> </ul>

		<ul style="list-style-type: none"> <li>▪ F – Harvest levels and patterns of harvest</li> <li>▪ F – Habitat capability</li> <li>▪ F – Impact on land</li> <li>▪ F – Population size and distribution</li> </ul>		
Resource Gaps	<ul style="list-style-type: none"> <li>▪ F – Available local in stores</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Research capability</li> <li>▪ C , F – Partnership with First Nations</li> <li>▪ C – Long term program and partners</li> <li>▪ C – Equal partnership in comanagement</li> <li>▪ C – Funding</li> <li>▪ C – Capacity</li> <li>▪ F – Maintain a work plan for programs and resources</li> <li>▪ F – Expansion of monitoring programs with dedicated budget</li> </ul>	<ul style="list-style-type: none"> <li>▪ G – Protocols for disease monitoring</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Better understand impacts</li> <li>▪ F – Model population dynamics under different management scenarios</li> </ul>

**Table A.E.3.** Summary table for mule deer. The table lists all management goals, management recommendations, monitoring needs, and resource gaps described by the scenario team. They are organized by scenario. Capital letters at the beginning of each bullet point refer to the management goal cluster (Table 3.3) to which the particular bullet point relates.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Management Goals	<ul style="list-style-type: none"> <li>▪ B – Reduce northern expansion of deer into the Yukon to reduce predation, disease transmission, and habitat competition</li> <li>▪ E – Monitor current populations and adapt as required</li> <li>▪ F – Increase moose and caribou population while maintaining a deer population</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Co-management. Collectively monitor selected habitat and behavior changes for bison, elk and deer</li> <li>▪ C – Determine impacts/changes from mining impacts</li> <li>▪ C – Determine landscape changes</li> <li>▪ C – Determine social impacts associated with a changing landscape</li> <li>▪ G – Increase/shift the profile of deer to a locally important species</li> <li>▪ F – Manage for a sustainable harvest</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Monitor deer populations and provide hunting opportunities while reducing overlap with caribou</li> <li>▪ A – Limit deer in key moose and caribou habitat if habitat is a limiting factor</li> <li>▪ F – Determine the extent of the population and manage as required</li> </ul>	<ul style="list-style-type: none"> <li>▪ E – Allow deer populations to naturally fluctuate and manage any impacts they may have on valued species</li> <li>▪ F – Implement an enumeration plan to better manage the population as well as decrease its environmental impacts</li> <li>▪ F – Manage for a sustainable harvest</li> <li>▪ F – Maintain and protect native wildlife populations and their habitats</li> </ul>
Management Recommendations	<ul style="list-style-type: none"> <li>▪ B – Liberalize hunting opportunities</li> <li>▪ B – Reduce or aggregate agricultural lands</li> <li>▪ B – Locate agricultural lands away from caribou and moose habitat</li> <li>▪ E – Continue current management</li> <li>▪ F – Survey population to understand numbers and distribution</li> <li>▪ G – Manage to provide a</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Determine what activities and the level of activity that causes various responses</li> <li>▪ C – Determine environmental changes</li> <li>▪ C – Determine landscape responses</li> <li>▪ F – Manage harvest</li> <li>▪ F – Conduct predation control program</li> <li>▪ F – Identify and manage critical habitats</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Increase education to encourage appreciation</li> <li>▪ A – Liberalize hunting of deer</li> <li>▪ A – Maintain viable, healthy deer population</li> <li>▪ A – Limit expansion into high value caribou habitat through hunting and habitat management</li> <li>▪ A – Protect key moose</li> </ul>	<ul style="list-style-type: none"> <li>▪ E – Provide for a modest harvest</li> <li>▪ E – Ensure deer do not impact other species</li> <li>▪ E – Allow populations to fluctuate naturally</li> <li>▪ E – Increase public appreciation and knowledge of deer</li> <li>▪ E – Prepare people to adapt, slowly, to increased use of deer in the future</li> </ul>

	<p>population that can sustain a harvest sufficient to meet local demands</p> <ul style="list-style-type: none"> <li>▪ G – Shift harvest pressure away from caribou and moose, help people adapt where willing</li> <li>▪ G – Increase public interest and appreciation</li> <li>▪ G – Hunter education to increase appreciation</li> <li>▪ G – Protect key deer wintering areas</li> </ul>		<p>and caribou habitat from deer by hunting</p> <ul style="list-style-type: none"> <li>▪ F – Survey population to understand numbers and distribution</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Minimize habitat-based competition between native species and deer</li> <li>▪ F – Identify overlapping habitats</li> <li>▪ F – Identify behavioral change</li> </ul>
Monitoring Needs	<ul style="list-style-type: none"> <li>▪ B – Population trends and distribution</li> <li>▪ B – Disease</li> <li>▪ E – Population and distribution, adapt as required</li> <li>▪ F – Habitat use</li> <li>▪ F – Interactions with humans and other species</li> <li>▪ F – Species adaptation</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Responses to mining development</li> <li>▪ C – Drivers of change and the effects and outcomes</li> <li>▪ C – Deer responses to environmental and landscape changes</li> <li>▪ F – Habitat use</li> <li>▪ F – Population recruitment level</li> <li>▪ F – Harvest levels and patterns of harvest</li> <li>▪ F – Population size and distribution</li> </ul>	<ul style="list-style-type: none"> <li>▪ A – Population trends and distribution</li> <li>▪ A – Disease</li> <li>▪ A – Habitat needs</li> </ul>	<ul style="list-style-type: none"> <li>▪ E – Population and distribution, adapt as required</li> <li>▪ E – Harvest interest and success rates</li> <li>▪ E – Impacts on land</li> <li>▪ E – Impacts to other species</li> <li>▪ F – Competition between native species and deer</li> <li>▪ F – Disease</li> <li>▪ F – Invasive species</li> </ul>
Resource Gaps	<ul style="list-style-type: none"> <li>▪ F – Unknown numbers and population cycles</li> </ul>	<ul style="list-style-type: none"> <li>▪ C – Research capability</li> <li>▪ C, F – Partnerships with First Nations</li> <li>▪ C – Long term programs and partners</li> <li>▪ F – Maintain a work plan for programs and resources</li> <li>▪ G – Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>▪ F – Adopt a program for deer</li> </ul>	<ul style="list-style-type: none"> <li>▪ E – Need a management plan</li> <li>▪ E – Establish a monitoring program</li> </ul>

		<p>programs with a dedicated budget</p> <ul style="list-style-type: none"><li>▪ G – Management plan that sets goals and directions</li><li>▪ G – A cooperative framework for management</li></ul>		
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## Appendix F. Scenario Narratives

Scenario Story Line – S1 – “Doom and Gloom”

High Cumulative Impacts, Unpredictable Change, Exploitative

### Yukon Herald – October 11, 2032

#### Yukoners Work/Play Hard as Landscape Changes Around Them

“What happened to hunting to fill your freezer?” is a commonly uttered question lately. In Supergrocery’s weekly sale pamphlet, chicken breast was listed at \$3.38/lb., the same price as in Toronto.

Because of cheap groceries, the surge of wage jobs, and changes to species composition and abundance out on the land, people hunt less frequently and mostly recreationally.

For those who continue to hunt, hunting has become a different ball game. During the past seven years, due to the “conservation concerns” provisions of the Umbrella Final Agreement, First Nation members have had hunting priority for caribou, sheep, and moose. This has meant that non-First Nation hunters have had to try their luck exclusively with elk, bison, or deer.

“Growing up we ate moose meat,” says 32 year-old and avid hunter Simon Caliber while looking up from a freezer full of venison. “There hasn’t even been a lottery for a caribou tag in several years. It’s still meat but it’s just not the same.”

According to Whitehorse District Conservation Officer Jim Walker, even though elk and wood bison populations have grown, the decline in hunting is not surprising. “Hunting takes time. A lot more time than walking down a grocery aisle.” He continues to say, “I think a lot of it has to do with what people grew up

with and people moving here from southern provinces may not have grown up with hunting as a way to put food on the table.”

Though even for First Nations it’s not all roses. Felix Jackson says, “There aren’t enough caribou and moose anymore to hunt those animals alone and we don’t have subsistence rights to bison and elk. If you want tags you have to pay. To pay you need a job. If you have a job you can only hunt on time off so you need a truck and a snowmobile to hunt faster. Since you have the truck and snowmobile you need the job. It is a cycle. Once you start you are stuck. Those subsistence ways are old ways.”

Because of reduced hunting pressure wildlife management and economic development on the landscape are the main things contesting growing numbers of elk, wood bison and deer.

“These species are taking over the ranges of caribou, moose and sheep. Simply put, they are better able to adapt to the current circumstances.” By current circumstances, Kluane Region Wildlife Biologist Leanne Rogers refers mostly to the human exploitative pressures that have changed wildlife habitat, but the landscape has changed in ways beyond human control as well.

**“The part that blows my mind is the variability. The weather can’t make up its mind.”**



As far as averages go, there is a trend towards warmer, wetter weather and increasing average temperature is the alleged culprit for much of the changes. “Subtle changes to temperature can cause a host of environmental responses. Everything is so closely linked,” says Karen Chang of Environment Yukon.

The story of climate in the SW Yukon can hardly be told by averages. In 2014 the Intergovernmental Panel on Climate Change flagged the western Arctic rim of North America as the “miner’s canary.” The southwest Yukon in particular has shown the rest of the world that climate change means extreme, unpredictable events.

“The part that blows my mind is the variability,” says Carmacks resident Keith Steady. “One year there is record setting snowfall and the next year there is a record low. There is rain one summer, then drought. The weather can’t make up its mind.”

The great swings in temperature from year to year have huge affects on snowpack, permafrost, and ice. Flooding has become the major concern across the southwest Yukon.

Homeowner Dan Lenza says, “Water levels on my land change year-to-year it seems,” an observation that is not an exaggeration. New ponds and wetlands appear suddenly as permafrost thaws, snowpack melts earlier and the pace of glacial melt quickens.

“Our river basins in the Yukon are experiencing higher volumes of water than ever before and it’s changing everything,” says Kathy Streams from the Department of Water Resources.

Kluane Region Wildlife Biologist Leanne Rogers says that wildlife is also having a hard time

adjusting to the variability. “Just last February both the Aishihik Caribou Herd and the Aishihik Wood Bison Herd had animals fall through thin ice. There weren’t enough cold days in a row for ice to thicken enough to support their weight.”

Rogers claims that the estimated 25 caribou that fell into the Nisling River was a significant blow to the population, but the over 100 bison that fell into Kloo Lake was barely a dent in the population.

**“As the southwest Yukon warms the spruce bark beetle becomes more and more of a problem.”**

Forester Jane Timber says that the severe weather and high levels of industrial activity in the southwest Yukon has made white spruce stands more susceptible to pests such as the spruce bark beetle.

According to Environment Yukon’s Karen Chang the warmer climate has helped some new pest insects move further north into the Yukon, such as the mountain pine beetle. More importantly, though, the time required for beetles to reach adulthood is shorter and more beetles are surviving the winter.

A weakened host and strengthened pest has been the recipe for increased beetle outbreaks and large swaths of beetle-killed forest throughout the SW Yukon.

Kluane Region Wildlife Biologist Leanne Rogers says, “As the southwest Yukon warms the spruce bark beetle becomes more and more of a problem. Beetle-killed spruce forest is mostly dead habitat for several years until the wind breaks off enough of the light blocking branchlets of the spruce

trees. Outbreaks have had tremendous impact on white spruce stands which provide good habitat for caribou and moose.”

When a forest stand becomes the site of a beetle outbreak it is privately logged and sold as woodstove fuel. But this is not always the case. Several times in the past few years lightning has struck before contracts can be negotiated.

“We have always had forest fires, but not with this frequency and with this intensity,” says wildland firefighter Jeff Spark. With the thousands of hectares of beetle-killed forest, there is plenty of fuel once the lightning strikes. And strike it does. Despite the SW Yukon being in St. Elias’s rain shadow, summer thunderstorms are 20% more likely than they were at the turn of the century, meaning more opportunity for lightning.

The Yukon Forest Management Branch reports that fires used to happen about once every hundred years in a given area. That cycle however is now a historical note.

“From what we have seen in the past 20 years, fires seem to be occurring at shorter, more irregular intervals. For the landscape, this means that spruce trees may not have sufficient time between fires to repopulate areas. Deciduous vegetation like willow and aspen are beginning to dominate the SW Yukon,” says Forester Jane Timber, citing the Takhini burn as the most mature example of the new trend.

**“It doesn’t matter if trees turn to shrubs or shrubs turn to trees. Gold will still be gold.”**

The Yukon’s response to a changing climate can be characterized as slow at best. Commitments set forth by the Climate Change Strategy (2006) and

Climate Change Action Plan (2009) fell short to spur the government into real action.

A main focus of the government’s agenda has been economic growth, largely through an increase of natural resource extraction and exportation, as well as providing the energy to power the growing economy.

“We know the climate is changing and that these changes manifest dramatically on the landscape. But we will not allow it to affect the way companies in the Yukon do business,” says Party spokesperson Brad Staunch.

And it hasn’t. The economy continues to boom without concern for a future that grows less certain and predictable. They invest and expect reward.

President and CEO of Rocky Mining, Ltd., Arthur Gold says, “It doesn’t matter if trees turn to shrubs or shrubs turn to trees. Gold will still be gold.”

Some of the biggest changes in the southwest Yukon in the past 20 years have come from the industrial sector, particularly mining. More and more mining claims are changing from exploration to production, and local mineral claims have been increasingly leased to out-of-territory or out-of-country companies.

Ten years ago today Rocky Mining, Ltd., an Alberta based company, constructed the Killermun mine and began mining quartz claims west of Killermun Lake within the Ruby Range. Residents of Haines Junction have watched their small town and life, as they knew it, transform over the years.

Helicopter blades chop the air as miners are trafficked to and from Haines Junction 5-6 times daily. Quiet summer sunsets are a thing of the past.

During time off, miners staying in Haines Junction are often spotted racing speedboats on Pine Lake, beer coolers full and music blaring. For the past nine summers, elders have not cast fishnets in the lake.

The fatal bear attack last year on a miner at the Killermun Mine campsite drove Rocky Mining, Ltd. to institute a “clean camp” policy to reduce the likelihood of bear attacks. Reports by trappers of beer cans left along ATV trails tell the story of the policy’s effectiveness. The company’s workers who, like the company, come from Alberta seem to lack the same spirit and respect for the natural world that defines a true Yukoner.

As forewarned by the Yukon Conservation Society within the YESAB files, the Killermun Mine has adversely affected wildlife populations. Stripping to uncover quartz veins destroyed natural licks used by sheep and reduced the fragile plants and grasses. Over 100km of ATV trails were built, resulting in fragmented habitat and increased access into the previously remote alpine region.

“With all of the commotion from the mine, Dall sheep spent huge amounts of energy being constantly alert. Many of them got weak and became easy targets for wolves,” says Conservation Officer Jim Walker.

Consequently, Dall sheep no longer use the area for spring lambing, a fact that Yukon Conservation Society believes to be affecting as many as 300 ewes.

Additionally, the Aishihik caribou herd, which had been recovering in the area as a result of significant management efforts, has not been seen there for several years.

“People have said for years that moose, caribou, and especially sheep are sensitive species. Research was just never clear about how sensitive. Well, now we know,” says Alice Munroe, Kluane Region Wildlife Technician.

Mining developments, though invasive, seem to not have affected elk and bison in the same way. Miners report seeing large herds walking new mining roads to travel between habitat patches.

Kluane Lake Outfitters have had to relocate hunting camps on account of the noise and deteriorated wildlife habitat, which has made it harder to find wildlife. The same outfitters report a drop in client satisfaction for guided trips in the area.

Chris Masterson of Kluane Lake Outfitters explains that, “several of his clients mentioned crisscrossing ATV trails making the landscape look less wild.” The wild, remote feeling of the landscape is a feature that has been a selling point of outfitting in the Yukon for generations but, as Masterson says, is disappearing.

Similarly, trappers with long traditional family ties to the area have reported significant drops in success along traplines. Champagne and Aishihik First Nation member Mary Agnes also adds, “I would love to run my family’s trapline and forget about working a job in the city, but how can I with the price of furs being so low?”

**“Coal just makes sense given the pace of new energy demands.”**

With the rapidly growing demands on the energy supply, Yukon Energy made the quick decision to embrace coal as a means to rapidly

increase the amount of energy available to both industry and new residents.

“Coal just makes sense given the pace of new energy demands,” explained Harvey Dam, Communications Supervisor for Yukon Energy back in 2017. When asked why Division Mountain, Dam replied, “The proximity of the Division Mountain coal deposit to the existing electricity grid and its economic feasibility made it an efficient choice for Yukon Energy.”

Between 2017 and 2027 Hard Minerals, Ltd. extracted 2.6 million metric tonnes per year (Mtpy) of coal from an open-pit mine on its Division Mountain properties. Two million Mtpy was washed and shipped to Pacific Rim markets, supplying China with 1.24 million Mtpy of thermal-grade coal. Yukon Energy continues to buy coal from Hard Minerals, Ltd. to supply the local power station (expanded from 50-megawatts to 100-megawatts in 2024) that is adjacent to the Division Mountain property.

Though sustainability initiatives took the back seat clean, reliable and affordable coal has helped to triple the territory’s 2012 energy production from approximately 400-gigawatts of hydro-generated power to today’s almost 1250-gigawatts of mixed hydro and coal-generated power.

### **The land-based economy of old dried up as prices and demand for land-based goods plummeted.**

No one is arguing whether or not the territory needs more power. The last 20 years has seen population growth of an average of 7% per year, resulting in a population of 132,000 for the territory. The 7% growth rate over the 20-year span is the highest in Canada.

Much of the population growth can be attributed to a series of industrial booms, the most recent of which has led to yet another influx of out-of-territory workers, many of whom are miners from Alberta the Yukon Bureau of Statistics shows.

More and more people born in the Yukon before the booms are claiming to be “true” Yukoners and feel like a minority. Native Yukoner Clay Johnson says, “Seems like ain’t too many people left who were born here. The new people sure think different too. Like everything can and should be blown up.”

All the new folks to the territory need housing and developers have scrambled to meet the challenge. Property rates have soared in response. The pressure for housing within commute distance of Whitehorse has transformed the drive along the Alaska Highway between Whitehorse and Haines Junction.

Most notably over the stretch, the Department of Highways and Public Works widened the highway to four lanes in 2018 to eliminate the dangers of commuters passing trucks. A wider road, though, means even higher maintenance costs due to permafrost thawing. Annual repairs are costing upwards of \$30,000/km of road.

There are also far more turnoffs than there used to be. Recently logged and in many cases agricultural land bordering the Alaska Highway have been converted into high-density subdivisions. The Bratnaber and Vanier Subdivisions are examples of new housing within the past 5 years. All 500 lots of the Vanier Subdivision sold the first day on the market.

Space was made for the Vanier Subdivision when Tom Schneider sold

his farm. “That’s the way of it,” Schneider says. “You can only stare down that kind of an offer for so long.”

Jill Farmer, a friend of Schneider’s, was surprised he was able to hold out selling as long as he did. “Smart though. 60km from Whitehorse and in this market, he made a killing.” It seems only the wealthiest Yukoners have been able to keep the homestead dream alive and ignore the sometimes multimillion dollar offers from real estate developers.

Many smaller towns and communities with long histories are also feeding into Whitehorse’s growth. “There used to be 800 people living here. 800!” exclaimed long-time Haines Junction resident Betty Fisk. The Haines Junction population, which for now sits at 3,200, is just close enough for people to make the daily commute to Whitehorse. Not to mention its closeness to Kluane region mining interests.

The population explosion has also coincided with increases in service and sales-related jobs to support a larger population. The Whitehorse Mall opened in 2017 with the slogan of “Tired of shopping online?” Cynthia Shopper says, “It’s great! I don’t need to fly to Vancouver to shop at the big stores,” adding, “Everything is right here in Whitehorse!”

In an effort to fill labor shortages in service positions Yukon Immigration has increased the number of applications through the Yukon Nominee Program. According to the Yukon Bureau of Statistics, during the 2026-2031 census period the Yukon welcomed 1,149 new immigrants, mostly from Asian countries.

The land-based economy of old dried up as prices and demand for land-based goods plummeted. Cabins rot as trappers continue to stay out of the bush. “I think the only ones of us still out here are the ones who are too old to know another way to live,” says 65-yr-old Garret “Snare” Hill.

Traps unset, berries unpicked and medicines uncollected. Old activities like these that once gave the Yukon a “last frontier” feel have disappeared, leaving those with the land at heart asking, “Do we have another Yukon to move to?”

by Dylan Beach

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This mock-article is part of a study to develop wildlife management based on future scenarios in the southwest Yukon. All names of people and companies within are intended to be fictional.

## Yukon Herald – October 11, 2032

### Hindsight is 20/20 as Management Fails to React

According to hunter Simon Caliber it is a frustrating time to be a hunter. “I haven’t been able to hunt a caribou or a sheep for several years and now there is a lottery on elk. What’s next?!”

Hunting has become a different ball game. During the past seven years, due to the “conservation concerns” provisions of the Umbrella Final Agreement, First Nation members have had hunting priority for caribou, sheep and moose in the southwest Yukon. This has meant that non-First Nation hunters have had to try their luck exclusively with wood bison, elk or deer tags.

That is, until last year.

“We got ourselves into a terrible position by not reacting fast enough,” says Karen Chang of Environment Yukon.

“Since the populations of wood bison, elk and deer have remained small there was no choice but to restrict hunting to a permit by lottery system,” says Buck Shot of the Hunting & Trapping Branch.

This year, in addition to a limited hunting season, Environment Yukon in conjunction with Champagne and Aishihik First Nations will be initiating a chemical sterilization program for wolves.

“It may be too late to really help the caribou, moose and sheep in the area but we hope that reducing the growth rate of wolves will spur the growth rate of bison, elk and deer,” says Chang.

Though she tried to remain polite, Chang made it clear that if Environment Yukon’s budget was even half as large as Energy, Mines, and Resources this problem would not exist.

**“We didn’t realize [wood bison, elk and deer] populations were so low until the most recent surveys.”**

Explaining how the southwest Yukon got in this situation can be boiled down to a couple of factors.

Wood bison, elk and deer populations seem to be low as a result of intense hunting, predation, and management without adequate monitoring.

Champagne and Aishihik First Nations Renewable Resource Manager Felix Jackson explains that, “wood bison, elk and deer populations were kept low and contained in order to help the native ungulate species, like caribou.”

Kluane Region Wildlife Biologist Leanne Rogers adds that, “We have spent our limited resources monitoring caribou, moose, sheep and predators while surveys of bison, elk and deer populations over the past 10 years have been spotty. We didn’t realize that they were so low until the most recent surveys.”

Area wildlife managers suspect that since hunting allocations were directed solely at wood bison, elk and deer, their numbers failed to pass

thresholds where they could continue to grow despite supporting a large harvest.

Wolf predation on bison and elk was low to nonexistent for roughly twenty years after introduction, but once wolves caught on to the new prey source predation increased rapidly.

The increasing predation from wolves, combined with intense hunting pressure and confining management policies has left the wood bison, elk, and deer in their current states.

**“Subtle changes to one thing can cause a host of environmental responses.”**

Caribou, moose, and sheep populations on the other hand seem to be low more so due to environmental and developmental changes on the landscape.

Environment Yukon’s Chang says, “We can see the general year-to-year environmental changes. Over the past 20 years the tundra has slowly receded while the treeline has advanced up mountainsides, particularly on southern slopes. Earlier snow melting, more rapid glacial melt, and permafrost thaw have all contributed to river levels rising.”

These changes, along with temperature increasing slightly, more snow during winters and less rain during summers, represent the southwest Yukon trends.

“The thing is that subtle changes to one thing, like temperature, can cause a host of environmental responses. Everything is so closely linked,” explains Chang. “For example, the recent dryness of our summers has decreased the quality of mosses and lichens, forage that caribou prefer. Higher water levels mean that a lot of

the willow that moose prefer has been flooded.”

Forester Jane Timber tells of how forest succession after fires and pest outbreaks has changed in the southwest Yukon. “Spruce species are not returning like they used to. Just look at the Takhini burn area. It is mainly aspen with a lot of open space and bison, elk and deer are much better suited for that type of landscape.”

Understanding how the landscape is changing allows managers to tailor management to the prevailing conditions. The problem is that without the science from proper monitoring, management recommendations seem unfounded.

**Increased access into the previously remote alpine region.**

But the larger impact over the past 20 years on caribou, moose and sheep populations in the southwest Yukon has been from development, particularly from the mining industry.

More and more mining claims are changing from exploration to production, and many local mineral claims have been leased to out-of-territory or out-of-country companies.

Ten years ago today Rocky Mining, Ltd., an Alberta based company, constructed the Killermun mine and began mining quartz claims west of Killermun Lake within the Ruby Range.

As forewarned by the Yukon Conservation Society within the YESAB files, the Killermun Mine has adversely affected wildlife populations. Consequently, Dall sheep no longer use the area for spring lambing, a fact that Yukon Conservation Society believes to be affecting as many as 300 ewes. Additionally, the Aishihik caribou herd,

which had been recovering in the area as a result of significant past management efforts, has not been seen there for several years.

Examples of mining impacts are stripping to uncover quartz veins, which destroyed natural licks used by sheep and reduced fragile plant and grass cover. Over 100km of ATV trails and roads were built, resulting in fragmented habitat and increased access into the previously remote alpine region.

“With all of the commotion from the mine, Dall sheep spent huge amounts of energy being constantly alert. Many of them got weak and became easy targets for wolves,” says Conservation Officer Jim Walker.

Kluane Region Wildlife Technician Alice Munroe reveals that, “People have said for years that moose, caribou, and especially sheep are sensitive species. Research was just never clear about how sensitive. Well, now we know.”

### **Mining developments seem to not have affected elk and bison in the same way.**

Mining developments, though invasive, seem to not have affected elk and bison in the same way. Miners report seeing herds travel between habitat patches on new mining roads.

“Simply put, wood bison, elk, and deer are better able to adapt to the current circumstances,” says Rogers. “At least in the southwest Yukon we need to shift our management focus to these species and talk about range expansion,” says Rogers.

Though, the idea of these species expanding their ranges has been a touchy subject for many parties. For example, Kluane National Park and Reserve,

managed by Parks Canada, has historically kept its borders closed to animals with lethal force.

“We worry about the bison in particular. We still don’t know enough about competition between bison and the native species to let them into the park,” explains Gary Park of Parks Canada.

With the management focus having been on containing the newer species to specific areas and population sizes, little new research has been done about impacts—a fact that continues to put many First Nations on the fence about letting the ranges expand into their territories.

### **People with different values are moving north to fill the vacant jobs.**

The most serious impact on southwest Yukon society has been a result of the expansion of mining projects and the influx of miners.

Even though the province created job training programs to encourage mining companies to hire local Yukoners, there are more available jobs at new mine sites than can be filled by Yukoners alone. This has meant that people with different values are moving north to fill the vacant jobs.

Looking at the impacts of the Killermun Mine on Haines Junction specifically, residents have watched their small town and life, as they knew it, transform over the years. The town has more than doubled in population from the 800 it was 20 years ago.

Helicopter blades chop the air as miners are trafficked to and from Haines Junction 5-6 times daily. Quiet summer sunsets are a thing of the past.

During time off, miners staying in Haines Junction are often spotted racing speedboats on Pine Lake, coolers



full and music blaring. For the past nine summers, elders have not cast fishnets in the lake.

Reports by trappers of beer cans left along ATV trails tell the story of the company's workers who, like the company, come from Alberta.

"Many of those mining types from down south lack the same spirit and respect for the natural world that defines a true Yukoner," says native Yukoner Clay Johnson.

**Only the wealthiest Yukoners have been able to keep the homestead dream alive.**

All the new folks to the territory need housing and developers have scrambled to meet the challenge. The pressure for housing within commute distance of Whitehorse has transformed the drive along the Alaska Highway between Whitehorse and Haines Junction. Property rates have soared in response.

Most notably over the stretch, the Department of Highways and Public Works widened the highway to four lanes in 2018 to eliminate the dangers of commuters passing trucks. Though, in permafrost thawing zones annual repairs are costing upwards of \$30,000/km of road.

There are also far more turnoffs than there used to be. Recently logged and in many cases agricultural land bordering the Alaska Highway have been converted into high-density subdivisions.

Space was made for the Vanier Subdivision when Tom Schneider sold his farm. "That's the way of it," Schneider says. "You can only stare down that kind of an offer for so long.

60km from Whitehorse and in this market, I made a killing."

It seems only the wealthiest Yukoners have been able to keep the homestead dream alive and ignore the sometimes multimillion dollar offers from real estate developers.

**Those subsistence ways are old ways.**

The current circumstances of reduced hunting and human population expansion has reinforced both the need for huge grocery stores like Superstore and the wage jobs that allow people to afford to buy from them.

CAFN's Felix Jackson puts the situation into context. "There aren't enough caribou and moose anymore to hunt those animals alone and you can't rely on getting a hunting tag from the bison or elk lottery. To eat you need to buy groceries. To pay for groceries you need a job. Those subsistence ways are old ways."

Echoing Jackson's sentiments, Hunting & Trapping's Buck Shot says, "You know, I think it is really only a core group of avid hunters who are upset by the hunting situation. Hunting takes time. A lot more time than walking down a grocery aisle." He adds that, "I think a lot of it also has to do with how people grew up and people moving here from southern provinces may not have grown up with hunting as a way to put food on the table."

**"The idea of a 'land-based' economy has reverted to mean mineral extraction, not goods like furs."**

Kluane Lake Outfitters have had to relocate hunting camps on account of the noise and deteriorated wildlife habitat, which has made it harder to find

wildlife. The same outfitters report a drop in client satisfaction for guided trips in the area.

“Outfitting has become a hard business,” says Chris Masterson of Kluane Lake Outfitters. “We can no longer guide for caribou or sheep, which were huge economic drives.”

He adds that, “several of his clients mentioned crisscrossing ATV trails making the landscape look less wild.” The wild, remote feeling of the landscape is a feature that has been a selling point of outfitting in the Yukon for generations but, as Masterson says, is disappearing.

Similarly, trappers with long traditional family ties to the area have reported significant drops in success along traplines. Champagne and Aishihik First Nations member Mary Agnes also adds, “I would love to run my family’s trapline and forget about

working a job in the city, but how can I with the price of furs being so low?”

Trapper Garret “Snare” Hill adds, “I think the government has forgotten the history of this territory and the activities that truly built it. Non-First Nation people came here for the gold but they fell in love with the land. They hunted and trapped. But the idea of a ‘land-based’ economy has reverted to mean mineral extraction, not goods like furs. It’s a shame.”

by Dylan Beach

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## Yukon Herald – October 11, 2032

### Management Blunders as Managers Learn to Roll with the Punches

Promises made by the Climate Change Strategy (2006) and Climate Change Action Plan (2009) have come to the forefront of government priority.

Since 2015 all new government buildings have been built to LEED Gold standards. By 2020 greenhouse gas emissions within government buildings were 50% less than they were in 2010. Today, all buildings are built on the premise of carbon neutrality.

Every Yukon Government department follows the Green Procurement Policy. When possible they purchase environmentally responsible goods and drive hybrid-electric vehicles.

Premier Alfred Greene’s administration even went as far as rewriting codes to prohibit companies without sustainability mandates from operating in the Yukon.

“I am proud to live in a place with a government that embraced the challenges of becoming truly sustainable, especially given the challenges of the climate here,” says Yukoner Clay Johnson.

To prepare for climate stresses, several government departments completed risk assessments in 2014 to understand vulnerabilities of infrastructure due to permafrost, water resources, forests, wildlife, and of communities. Yukon Government also implemented extensive monitoring programs in each area that continue today.

“These programs have been expensive, but important expenses,” says Premier Alfred Greene.

“When the climate change adaptation tax appeared in 2020 I realized YTG had decided to take their climate change agenda seriously. I gladly pay the tax knowing it’s supporting green building and other sustainable initiatives,” says homeowner Dan Lenza. “In fact, that leadership is what helped me decide to upgrade to a more efficient wood pulp stove.”

The Climate Change Secretariat revamped Yukon Government’s climate change education, offering evening workshops on dozens of climate change related topics. Lenza says it was one of those workshops that taught him about wood stove efficiency and other ways to be sustainable at home.

**“There is a wealth of mineral resources in the Yukon, but Yukoners are against using the landscape in that way.”**

There have been more changes than just new wood stoves and over the past 20 years the mining industry has seen the greatest of these changes. Older, large-scale projects have mostly closed down while new, large-scale projects have been for the most part halted at the feasibility stages.

For example, the Killermun properties within the Ruby Range, which underwent advanced feasibility studies

in 2012, were held back from production by YESAB due to potential disturbances of Dall sheep spring lambing.

Everywhere in the Yukon, projects are occurring at smaller scales than what plans may have indicated 20 years ago. Massive mining operations, like Casino, never made it past advanced feasibility planning stages.

Mining Lands Officer James Pickett says, “That operation was going to be huge, with a road going right through Carmacks. We were talking 650 employees and a 100MW power generating station for the mine alone. We were not crazy about what that could do to the area. Can you imagine bringing in that many people from the outside?”

“There is a wealth of mineral resources in the Yukon, but Yukoners are against using the landscape in that way,” says Director of Mineral Resources Tony Brock. “That is why right now we are only pursuing smaller, less environmentally disruptive operations.”

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Agriculture is another sector that focuses on small-scaled operations.

Jill Farmer says, “With this climate most of what you see are greenhouse-based, family-owned organic farms that aren’t very land-intensive.”

Farmer continues to say that, “there is a huge demand for people to try to eat locally and so hunting is extremely important, but when it comes to supplementing that meat with fruits and vegetables small farming that maintains the health of the soil is important.”

Dale Pepper of the Yukon Agriculture Association says, “There is a line between the kind of farming that is in harmony with the land and the kind that isn’t. The scale of southwest Yukon agriculture and the sustainable practices keep that balance. Space is left for the wildlife and pesticides are kept out of the watersheds.”

**After living here, it is not the gold that calls you it’s the land’s beauty and stillness.**

The words of Robert Service’s “The Spell of the Yukon” remind people why a small economy is important. After living here, it is not the gold that calls you it’s the land’s beauty and stillness.

Chris Masterson of Kluane Lake Outfitters explains that he gets tired of economic arguments for huge resource extraction projects. “Leaving the land the way it is is an economic investment in itself. The wild, remote feeling of the landscape is a feature that has been a selling point of outfitting in the Yukon for generations.”

Other Yukoners agree with Masterson. Mary Agnes says, “Keeping mining companies and other industries small is important for trapping. I am excited every day that I wake up knowing I have my family’s trapline to stay connected to the land. It’s special out there. Always has been, always should be.”

**Changing environmental conditions have provided avenues for new species of bark beetles to expand north.**

But that special place has changed and continues to do so. Rivers flow higher due to melting glaciers while droughts have lasted entire summers.

Trees move further upslope as the tundra recedes. In many places, aspen has taken over after spruce failed to grow back after fires and beetle kills.

In the past 20 years southwest Yukon forests have been hit more times by bark beetle infestations than ever before in written or oral record. Though not a new threat, spruce bark beetle outbreaks have increased. But what are most worrisome are cases like the 2017 mountain pine beetle outbreak that decimated lodgepole pine in the area.

The outbreak meant that southwest Yukon forests were no longer under assault from the same old pests. Changing environmental conditions have provided avenues for new species of bark beetles to expand north.

In 2018 the Yukon Forest Management Branch responded with an intensive proactive management regime. They brought in Fire Cuts, a company from British Columbia that specializes in sustainable selective harvesting techniques, to harvest small patches of dead and stressed, dying trees. Yukon Energy then buys the harvested trees to supply a wood pellet burner.

From a forest management perspective, “the selective harvesting regime was intended to serve many purposes. Removing dead and dying trees would control stress on trees due to dry summers, remove forest fire fuel loads, and help reduce the number of susceptible hosts for beetles,” says Jane Timber of the Yukon Forest Management Branch. She added, “Ideally we wanted to prevent large-scale beetle outbreaks and forest fires by promoting healthy trees.”

Regarding the wood pellet burner, Dan Burns of Yukon Energy says, “We realize that there are emissions from burning the wood pellets

and that people were upset at the decision to burn wood pellets as an energy source. But from a sustainability standpoint we felt that wood pellet emissions are less of an environmental impact than diverting and ultimately flooding the Gladstone Lakes system for additional hydro capacity at our Aishihik facility.”

Yukon Energy Communications Supervisor Harvey Dam says, “We wanted to look more into geothermal energy, but with the unpredictable changes to permafrost and how that is affecting our aquifers; it just isn’t stable right now.”

One of the tempting aspects of the wood pellet energy project was the ability of Yukon Energy to sustain it. “Not including beetle-killed wood, harvesting and replanting an eight square kilometer area of forest is all the energy we need to run a one-megawatt generator indefinitely, or enough to power about 1000 homes,” Burns says.

But not all plans work as intended. Thinning out forests made them more susceptible to wind, which in itself increases a forest’s susceptibility to fire. Not to mention, “thinner forests alter habitat dynamics for wildlife and may have contributed to the decreasing caribou and moose populations, while at the same time aiding wood bison, elk and deer by opening up forests and creating small meadows,” says Kluane Region Wildlife Biologist Leanne Rogers.

**Unintended consequences and high expense, low result management seemed to be a common thread.**

In the ten years between 2012 and 2022, unintended management consequences and high expense, low

result management seemed to be a common thread.

Worried about low numbers of caribou and moose, wildlife managers felt pressured to reach back to the 1992-1997 Aishihik wolf control plan. This time, managers exclusively used sterilization techniques to control wolf numbers with the hopes that reducing wolf numbers again would help caribou and moose calves survive to adulthood.

In the narrow scope of the plan, managers forgot about potential affects to the “newer” ungulates. Rogers admits that, “We forgot about bison, elk and deer. The first time we controlled wolves with management they weren’t really an issue. With reduced predator pressures elk, deer and even wood bison populations exploded. We didn’t realize how much wolves were controlling these other species.”

Ultimately, The Department of Wildlife & Biodiversity spent huge portions of its operating budget on caribou, moose and sheep management trying to keep their populations viable. But, “at a certain point,” Rogers says, “nothing you do will elevate caribou populations if their habitat requirements are disappearing.”

Prioritizing some species over others has real impacts on species of less priority. For example, in the summer of 2028, CAFN hunter Felix Jackson reported finding several aborted wood bison fetuses to his Renewable Resource Officer. The fetuses were tested and confirmed to be infected with brucellosis by The Animal Health Unit at Environment Yukon.

“I figured there must’ve been something wrong with ‘em if a bear didn’t eat ‘em,” observed Jackson.

“Brucellosis is a concern because of its transferability to humans and

animals,” says wildlife veterinarian Angela Bovine, “and could pose a threat to the herd’s viability if it goes untreated.”

The appearance of the disease raised several questions that have yet to be fully answered. Where did it come from and are other diseases present in the bison or elk herds that we might have missed because wildlife managers did not monitored closely enough?

In the future anthrax outbreaks, which killed 400 wood bison in the Mackenzie Bison Sanctuary in the Northwest Territories in 2012, could become a problem considering how the sw Yukon area recently has seen flooding and subsequent droughts, conditions that promote increased concentrations of anthrax spores.

Timber says it is a difficult time to be a resource manager. “We try to be proactive with resource management whenever possible, but with how fast and unpredictable things are these days we are often forced to react. You can’t plan for animals falling through thin ice, freak blizzards, or prolonged summer droughts.”

Because of these past management blusters, resource managers have had to take a hard look at management tactics in the face of abrupt and unpredictable changes. Environment Yukon’s Karen Chang says, “We accept that what is happening is beyond our ability to control with management. We can’t repeat past mistakes.”

Rogers adds that, “From a wildlife perspective this means pulling some of the resources for species that were intensively managed in the past, such as caribou, and directing them towards improved monitoring programs geared towards landscape resilience and species that are doing well with the

environmental changes, such as bison and elk.”

According to Rogers, this is especially necessary considering that “research reports coming in are often outdated by the time they are read, so it is hard to plan management on science that may have in fact already changed.

“Then, it is difficult to even reactively manage when you have to budget money in March for the entire upcoming year. Money runs out.” When this happens Rogers says that her office adopts a “roll with the punches” attitude. However, in recent years it has become *the* attitude.

Initially decisions to shift management priorities were not popular with the public. But both Environment Yukon and First Nations governments in the southwest Yukon agree that management has to be directed where it can be effective.

“Management has changed to focus more on resilience of the landscape,” says Chang. “To achieve this we are promoting cooperation between departments.”

Rogers says, “Limiting non-climate stressors is the best thing we can do for the Yukon’s wildlife. We have worked with Energy, Mines, and Resources to reforest unused logging roads and looked at ways to reduce pollution and erosion from mining operations.”

**“People slowly realized that there are other animals that can fill a freezer.”**

Reevaluating values has gone beyond resource management to Yukoners in general. As populations of caribou, moose, and sheep dwindled, people began to appreciate wood bison, elk, and deer.

“Those of us with our eyes on the land could see the changes to the wildlife,” says Champagne and Aishihik First Nations trapper Mary Agnes. “We just don’t have the same cultural ties to those elk and bison that seem to be everywhere.”

Agnes says that it took her a long time to begin appreciating wood bison especially. “A few years back they ruined a cabin on my trapline and their yellow fat still grosses me out. If the disease issue isn’t contained, that could be a real problem. But better a bison to hunt than nothing.”

Statements like this represent the swing in opinion that gripped many Yukoners through the past 20 years. Hunter, Simon Caliber, reflects that it was pandemonium when conservation concerns provisions of the UFA were implemented for caribou, moose, and sheep in 2025.

“People acted like there was some huge crisis. But like everything it faded. I think people slowly realized that there are other animals that can fill a freezer,” Caliber says and adds, “To be honest, elk is the best eating out there.”

Garret “Snare” Hill explains that he is just happy that he can continue living off of the land. “It is harder than before,” He says. “You don’t know whether your piece of the forest will be there come the morrow, but that’s part of the thrill, isn’t it?”

by Dylan Beach

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### Management Looks to Future as it Adapts to Slow Changes

Premier Alfred Greene explains that his government’s goal is to “create and maintain a place to live that avoids the unstable boom and bust cycles of so many economies. One way we sought to accomplish this was to focus our economy and energy systems on sustainable solutions. This government understand that we humans are just one part of the system, and its functioning depends on us not abusing our place in it.”

The Premier was not just politicking with that statement. Since 2015 all new government buildings have been built to LEED Gold standards. By 2020 greenhouse gas emissions within government buildings were 50% less than they were in 2010. Today, all buildings are built on the premise of carbon neutrality. Additionally, every Yukon Government department follows the Green Procurement Policy.

#### **Yukon Energy committed to green, renewable energy solutions.**

Around 2016, Yukon Energy committed to green, renewable energy solutions and decided to be a model for the rest of Canada as a way to move forward in answering energy demands. Recognizing that the Yukon lies on significant fault lines, geothermal energy production was a no brainer.

In 2017 Yukon Energy commissioned a geothermal feasibility

study for the southwest Yukon by Genergy, Inc. The study showed high potential for ground water heating pumps in Haines Junction, Carmacks, Burwash, and parts of Whitehorse.

Since 2019, local municipalities have been installing geothermal heat pumps in buildings, reducing emissions from heating and cooling by up to 94%.

“Geothermal heat pumps are very energy efficient. They produce three to four times as much heat energy as they use and can heat or cool buildings depending on the outside weather,” says Yukon Energy Communications Supervisor Harvey Dam.

Yukon Energy hopes to make geothermal heating available to single-family homes soon. Until then, they encourage efficient wood pulp burning stoves. “A lot of wood after beetle kills or fires is salvageable and is a valuable heat source,” says Dam.

Even though hydropower is clean many people are uncomfortable with the impacts when a dam is erected at a new location.

Yukon Energy looked hard into the Gladstone Diversion Concept, a plan that would reverse the flow of Gladstone Creek and send the water through a canal into the Isaac Lakes. The plan would have likely caused water levels to rise and for some of the Gladstone lakes to merge.



Harvey Dam says, “The project would increase the capacity of our Aishihik Hydro Facility by 18 gigawatt hours of power per year, but people aren’t interested in seeing those kinds of changes on the landscape.”

Geothermal is clean and avoids environmental impacts like flooding valleys. Yukon Energy’s one concern is the long-term viability of geothermal. It is possible that in the future permafrost thaw could disrupt the geothermal reservoirs. For now, though, it is still a good solution.

**“Understanding how the landscape is changing allows us to tailor management to those conditions.”**

Future changes, like those to permafrost, are of high concern to Yukoners. Karen Chang of Environment Yukon says, “We’re pretty lucky. Things are changing fast enough that we can tell change is happening and how, but not so fast that we can’t adapt management.”

In 2014 Yukon Government, First Nations governments, and various university research teams collaborated to complete risk assessments to understand vulnerabilities of infrastructure due to permafrost, of water resources, of forests, of wildlife, and of communities.

The partnerships also worked to implement an overarching “Eyes on the Land” monitoring program. The program continues today and has focused on areas from the risk assessments.

“This program has been expensive, but an important expense,” says Premier Alfred Greene. “University contributions to research in the southwest Yukon has been invaluable.”

Chang says, “The monitoring programs have enabled us to see year-to-

year changes on the landscape. Over the past 20 years the tundra has slowly receded while the treeline has advanced up mountainsides, particularly on southern slopes. Earlier snow melting, more rapid glacial melt, and permafrost thaw have all contributed to river levels rising.”

According to Chang these changes, along with temperature increasing slightly, more snow during winters and less rain during summers, represent the southwest Yukon trends. “Understanding how the landscape is changing allows us to tailor management to those conditions.”

Kluane Regional Wildlife Biologist Leanne Rogers explains that, “caribou and moose have been slowly declining over the past 20 years but with the knowledge gained from the monitoring programs huntable numbers have been successfully maintained.”

Through monitoring it was learned that predation pressure on caribou and moose from wolves was extremely high. In response Environment Yukon began a chemical sterilization program for wolves and an incentive program for trappers, granting small subsidies for wolf or coyote furs.

**Wood bison, elk, and deer have not struggled under changing conditions.**

Unlike caribou and moose, wood bison, elk, and deer have not struggled under changing conditions. Wood bison and elk, which were reintroduced, have thrived and their populations have been heavily restricted to their original areas of reintroduction.

Champagne and Aishihik First Nations Renewable Resource Manager Felix Jackson says, “Allowing wood bison or elk to expand beyond their

current ranges would require other First Nation governments to manage them. Our resources should be directed at the native species that are important to us culturally.”

Finances are only one reason for constraining elk and bison expansion.

“There is less and less quality habitat for caribou and moose. Forage quality, especially of mosses and lichens, has decreased with the dry summer conditions. We want to keep wood bison and elk off of what good habitat remains to reduce possible competition,” says Jackson.

Parks Canada maintains the same stance with regards to wood bison and elk and continues to keep its borders closed to the animals with lethal force.

Despite the present focus of management on preserving native species, managers are not blind to the truth of current trends.

Kluane Regional Wildlife Biologist Leanne Rogers says, “More and more habitat patches are being created that favor wood bison, elk, and deer. Trees are dying one way or another, from fire, insects, or drought and this is opening up the forests.”

Other worries are about major events and the response of the southwest Yukon landscape.

“We have had the occasional fire and beetle outbreak over the past 20 years. Nothing unusual about that,” says Jane Timber says. “What is different is forests aren’t coming back like they used to after major disturbances. Aspen mostly succeeds like after the Takhini burn, but in some cases it has turned to steppe.”

**“The yellow fat still freaks me out, but I have bison in my freezer.”**

Forward thinking about the possibility of habitat converting to favor some species over others has definitely built tolerance for wood bison, elk and deer within wildlife management circles. For other Yukoners, even with the present lack of cultural significance and the worry of competition with other animals, the newer ungulates seem to be on the landscape to stay.

“They are valuable species for their ability to remove hunting pressure from caribou and sheep,” says Chris Masterson of Kluane Lake Outfitters. “Sheep and caribou are popular Big Game animals and bringing people to hunt them is an important part of the economy, whereas someone looking for meat for their freezer is often happy with an elk.”

Time is another factor for Yukoners with wage jobs that validate bison, elk and deer.

“Most times when I hunt I only have a day or two to bag an animal. It can be hard to find a caribou, moose, or sheep in that time. But elk, I can find a whole herd of elk walking on the side of the road,” says hunter Simon Caliber.

But for people living on the land, bison can be disruptive. Mary Agnes says, “Bison have wrecked entire traplines of my family’s before, have rubbed against my cabin, and don’t even talk to me about muskrat push-ups. There is one area close to a trapline of my family’s that bison use to wallow every summer. There used to be willow there with moose but now it is just open mud and grass.”

When asked if she eats bison Agnes said, “The yellow fat still freaks me out, but I have bison in my freezer. I like to make smokies out of ‘em.”

One thing that outfitters, hunters, and trappers alike have in common is the

appreciation for their opportunities to engage with the land.

Agnes says, “I love to live in my cabin through the winter, eating what I have hunted and gathered and checking my traplines.”

She adds that there are few places left in the world where you can live entirely from the land in this way, but get into town if you need something and buy it from a locally owned store rather than a chain.

**In the mining industry, large projects have mostly shut down in favor of smaller operations.**

The repulsion of many national chain companies within the last 10 years well defines the attitude of southwest Yukoners.

“People boycotted stores without proven environmental records,” says Whitehorse resident Cynthia Shopper. “And some of the bigger stores, like Supergrocery, were just so big and impersonal. Who wants to shop at a place where you can’t see the people that it benefits?”

Smaller development seems to be a trend in other areas of the economy as well. In the mining industry, large projects have mostly shut down in favor of smaller operations.

For example, the Killermun properties within the Ruby Range, which underwent advanced feasibility studies in 2012, were held back from production by YESAB due to potential disturbances of Dall sheep spring lambing.

Everywhere in the Yukon, projects are occurring at smaller scales than what plans may have indicated 20 years ago. Massive mining operations, like Casino, never made it past advanced feasibility planning stages.

Mining Lands Officer James Pickett says, “That operation was going to be huge, with a road going right through Carmacks. We were talking 650 employees and a 100MW power generating station for the mine alone. We were not crazy about what that could do to the area. Can you imagine bringing in that many people from the outside?”

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